LIBRARY
SUPREME COURT, U.S.

Office - Supreme Court, U.S.
FILED
DEC 16 1957
JOHN T. FEY, Clerk

No. 673

APPENDIX TO THE BRIEF OF PLAINTIFF-APPELLEE

United States Court of Appeals for the Fourth Circuit

No. 7298

SEARS, ROEBUCK & COMPANY AND THE PLYMOUTH RUBBER COMPANY, INC., *Defendants-Appellants*,

v.

MINNESOTA MINING AND MANUFACTURING COMPANY, *Plaintiff-Appellee*

Appeal from the United States District Court for the Middle District of North Carolina Greensboro Division

WELCH JORDAN,
Attorney for Plaintiff-Appellee

Of Counsel:
LAWRENCE C. KINGSLAND,
ESTILL E. ESTILL
Saint Louis, Missouri
HAROLD J. KINNEY
Saint Paul, Minnesota
M. K. HOBBS
Platteville, Wisconsin

INDEX

Excerpts from Testimony and Proceedings at the Trial:

	Page
Excerpt from Defendants' Opening Statement	2
Plaintiff's witnesses:	
H. J. Tierney, Direct	2
H. J. Tierney, Cross	40
R. I. Parker, Direct	59
C. A. Womack, Direct	63
G. S. Miles, Jr., Direct	64
R. V. Holton, Direct	66
Defendants' witnesses:	
J. M. DeBell, Direct	68
J. M. DeBell, Cross	76
J. M. DeBell, Recross	106
W. M. Bieringer, Direct	107
W. M. Bieringer, Cross	109
F. L. Kozol, Direct	110
Excerpts from Deposition Testimony:	
Depositions taken by Plaintiff in Boston, Massachusetts, commencing February 9, 1955:	
M. M. Danovitch, Direct	112
Depositions taken by Plaintiff in New York City commencing April 20, 1955:	
Paul Shalita, Direct	115
Paul Shalita, Redirect	116

Page

M. C. Reed, Cross 117

Depositions taken by Defendants in Philadelphia, Pa., commencing March 21, 1955:

Louis Klein, Cross 119

E. M. Beavers, Direct 121

E. M. Beavers, Cross 124

A. L. Blount, Direct 125

A. L. Blount, Cross 125

Depositions taken by Defendants in Boston, Mass., commencing June 9, 1955:

Proceedings before Judge Ford (Deposition of R. W. Lundbohm) 126

Depositions taken by Defendants in Bridgeport, Conn., commencing April 7, 1955.

I. C. Eaton, Cross 127

Depositions taken by Defendants in Saint Paul, Minn., commencing January 31, 1955:

E. E. LePage, Direct 130

R. B. Snell, Direct 135

R. J. Oace, Direct 137

W. E. Lundquist, Direct 141

Excerpts from Plaintiff's Exhibits:

Plaintiff's Exhibit 2—File History of the original Oace et al Patent No. 2,559,990. 144

Plaintiff's Exhibit 4—File History and Contents of Oace et al Reissue Patent in Suit, Re. No. 23,843... 145

Page

Plaintiff's Exhibit 5—Consolidated Requests for Admissions, directed to defendants, Sears Roebuck and Plymouth Rubber, and their Responses. 158

Plaintiff's Exhibit B-17—Danovitch Deposition, "Kabelitems", Bakelite Company Publication. .. 173

Plaintiff's Exhibit 19—Chart illustrating plaintiff's analysis of claims in issue, verbatim, Claims 1 and 6..... 174

Plaintiff's Exhibit T-15 176

Plaintiff's Exhibit T-15A 176

Plaintiff's Exhibit T-16 178

Plaintiff's Holton Exhibit 12 180

Plaintiff's Holton Exhibit 13-B 181

Shalita Exhibit 3-E (New York Depositions)..... 182

Excerpts from Defendants' Exhibits:

Defendants' Exhibit 67—Nickerson patent No. 2,554,791 183

Defendants' Exhibit 68 187

Defendants' Exhibit 42 (Philadelphia Depositions) 188

Defendants' Exhibit 50 (Philadelphia Depositions) 189

Defendants' Exhibit 25 190

Defendants' Exhibit 12 (St. Paul Depositions) 191

Defendants' Exhibit 2 (St. Paul Depositions)..... 192

Defendants' Exhibt 10 192

UNITED STATES COURT OF APPEALS
FOR THE FOURTH CIRCUIT

No. 7298

SEARS, ROEBUCK & COMPANY AND THE PLYMOUTH RUBBER COMPANY, INC., *Defendants-Appellants*,

v.

MINNESOTA MINING AND MANUFACTURING COMPANY, *Plaintiff-Appellee*.

Appeal from the United States District Court for the Middle District of North Carolina Greensboro Division

---

APPENDIX TO THE BRIEF OF PLAINTIFF-APPELLEE

EXCERPTS FROM TESTIMONY AND PROCEEDINGS AT THE TRIAL

The above-entitled causes, having been consolidated for the purposes of trial, pursuant to Order of Court dated January 7, 1955, came on to be heard before The Honorable

Johnson J. Hayes, United States District Judge, at Greensboro, North Carolina, on November 1, 1955, when and where the following proceedings, among others, were had.

• • • • • • • • • • •

Excerpts from Defendant's Opening Statement

23 *** I won't discuss the validity of this original patent. They did a very good technical job in putting these plasticizers together, and getting an excellent product. Well now, what happened? I don't know why they weren't able to use G-25 satisfactorily, whether their technique was wrong. We always have a lot of trouble with it, or what happened. They weren't able to.

• • • • • • • • • • •

Plaintiff's witness **Hubert James Tierney.**

Direct Examination

By Mr. Lawrence C. Kingsland:

42 Q. Will you state what your present occupation is?

A. I am presently employed by the Minnesota Mining & Manufacturing Company.

Q. What was your formal education, Mr. Tierney? A. I received the degree of Bachelor of Science in Chemical Engineering offered by the University of Minnesota.

Q. When did you first become connected with the plaintiff in this case, that is, the Minnesota Mining & Manufacturing Company? A. I first entered the employment of Minnesota Mining & Manufacturing Company in 1927, in June of that year.

• • • • • • • • • • •

44 There are over three hundred standard pressure-sensitive adhesive tapes that our firm makes, and since 1931, and even since 1927, as I made reference to

earlier, I have been interested in the research and development problems of all the various types. From 1931 to 1934 constituted the period when I was charged with the responsibility of research and further development of the Cellophane and transparent non-fibrous film-back type of
45 pressure-sensitized adhesive tapes, such as the SCOTCH brand transparent Cellophane tapes.

• • • • • • • • • •

I was chief chemist from 1934 until 1943, at which time I was made tape products manager. That included additional responsibilities on the quality-control part of the production of all the different types of tape that our company manufactured. I was tape products manager from 1943 until 1948, at which time I was made manufacturing manager of the tape division of our company, and I was manufacturing manager from 1948 until 1952, at which time I was made a vice-president of the corporation and placed in charge of all tape research development and tape manufacturing of Minnesota Mining & Manufacturing Company.

Q. Mr. Tierney, have you had occasion to testify at any other time in patent cases; if so, what? A. Yes, I have testified in the patent infringement suit involving the Cellophane tape patent, that is, the Drew 2,177,627 patent
46 that was in the Seventh Federal Circuit in Chicago in 1945. I testified again in a different case involving that same patent in 1946. I testified in a different infringement suit concerning that same patent in the Second Federal Circuit in New York a little less than one year ago. That suit was Minnesota Mining & Manufacturing Company versus Technical Tape Corporation. I believe I left out that I also testified in a further suit on the Drew 2,177,627 patent in Chicago in 1952. That was Three-M

Company, or Minnesota Mining & Manufacturing Company, versus Neisner Brothers.

Q. Mr. Tierney, will you state generally what preparation you made to testify in this particular case? A. I have carefully studied the Oace, et al., reissue patent. I have reviewed the experimental work of the patentees, Oace, Esther LePage and Snell. I have studied the eleven U. S. patents and the one foreign patent, the Swiss Bierbrauer patent, and the twenty or more publications that have been cited by the defendant in this proceeding. I have also had a number of different examples of tape made in accordance with the Oace patent and have also had other samples prepared in connection with this proceedings.

47 Q. In your present activities, have you, yourself, at any time had occasion to try to make a pressure-sensitive tape on a vinyl film backing? A. Yes, I have.

Q. Will you recount your experiences in that connection? A. I can recall specifically that in 1938 I made a number of attempts to make a satisfactory vinyl film-back pressure-sensitive adhesive tape. At that time I attempted to utilize the plasticized vinyl chloride film backing made by B. F. Goodrich Company and merchandised under their brand name of KOROSEAL. I believe I may have made earlier efforts to utilized transparent vinyl film backings for pressure-sensitive adhesive tapes than then, even 1938. I remember the experiments with reference to KOROSEAL very specifically. All attempts were unsatisfactory. The pressure-sensitive adhesives became very soft and gooey and pasty and in any attempt to unwind the rolls the adhesive split, leaving half of the adhesive on the back side of the underlying layer of backing.

Q. Did you form any opinion as to why it was difficult

to make a commercially successful pressure-sensitive tape at that time; I mean the reason for your failure? A. Yes. Polyvinyl chloride resin itself is a very hard, brittle and non-elastic thermoplastic resin. The polyvinyl resins were known as early as the eighteen hundreds and a number of references in the literature have appeared with respect to these resins. They did not, however, come into very widespread commercial utilization until the 1920's and 30's, at which time they began to be utilized as substitutes for rubber, because these hard, inelastic resins, when they are plasticized as they were at that time, they develop flexible properties that made them suitable as a replacement for many of the places where rubber had formerly been utilized. These plasticized vinyl resins, however, as they were being made in the 20's and 30's, when attempts were made to coat pressure-sensitive adhesives on such plasticized films many difficulties were encountered. The difficulties were, namely, the same as those I have described with reference to my own experience: The pressure-sensitive adhesives absorbed the migratable, oily type plasticizers that were then used to plasticize the polyvinyl chloride, or vinyl chloride-vinyl acetate copolymer resin, and in the process of being added to the pressure-sensitive adhesive they spoiled the original character of the pressure-sensitive adhesives.

48

Q. Prior to the time that the inventors in suit succeeded in producing this type of tape, did any other researchers connected with your organization have occasion to experiment in connection with the production of such a tape? A. Yes. Warren Hurd, who was a chemical engineer in our laboratory at that time, attempted to make stretchable vinyl-film backed inner-sole bonding tape, namely, a stretchable pressure-sensitive adhesive-coated

49

tape that was aimed at utilization in the shoe industry for bonding the edges of inner soles. His attempts also were a failure and all experimental lots, which constituted quite a number of different attempts that he made, were unsatisfactory, because the pressure-sensitive adhesive became soft and pasty and with very short age, and the tape was so gooey and sticky as to be non-usable for his original purpose.

Q. Were you familiar with the work that was done by Ralph J. Oace and his co-inventors to make the pressure-sensitive stretchable and retractable insulating tape? A. Yes, I was very familiar with his work and that of the rest of the team that was working with him on that problem.

Q. In the first place, who was Mr. Oace? A. Ralph Oace is a graduate chemical engineer from the University of Minnesota. He entered our employ, that is, the tape laboratory of Minnesota Mining & Manufacturing Company, in 1937. He is currently employed, so that he's worked with our company continuously since that time. From 1941 to the latter part of 1945 he was in charge of electrical products section of the tape research laboratory of our firm.

Q. So he was in that employ in 1944 and 1945, that is to say, the electric tape laboratory? A. Yes, even before that time, from 1941 up to the latter part of 1945.

Q. Now I wish you would tell us something about the knowledge you have of the efforts that were made by Oace and his co-inventors in the development of this pressure-sensitive stretchable and retractable insulating tape. A. We had wanted to make a stretchable plastic film-backed tape for quite some time. In the latter part of 1943 and 1944 it was a very active project on our research program.

Ralph Oace was in charge of that project, which was, namely, to attempt to develop a stretchable and retractable electrical insulating pressure-sensitive adhesive tape. In the course of his work Miss Esther Eastwold, who is the present Mrs. LePage, also collaborated with him on that project. She was employed in a different laboratory, namely our central research laboratories, but she investigated
51 and did a great deal of work in connection with that problem or project and worked closely with Mr. Oace. In June of 1944 Mr. Robert Snell completed the rest of that project team in working toward that objective of attempting to develop that type of pressure-sensitive adhesive tape.

* * * * * * * * * *

They investigated a great number of different plastic materials, synthetic polymeric materials, which included nylon and various types of polyvinyl resins. They investigated a great many different plasticizers and blends of those plasticizers, made numerous experiments on combining and sheeting out film backings of such compositions and then priming them and coating them with a number of different types of pressure-sensitive adhesives. They were investigated through the slitting departments, tested for electrical insulating performance, aging life, in fact, the whole list of tests that would be necessary to indicate whether such compositions as they had developed would age satisfactorily to provide the long-aging type of stretchable and retractable pressure-sensitive adhesive insulating tape.

Q. Can you put an approximate number on the experiments that were conducted before they reached the solution of this problem? * * * A. I know there were well
52 over two hundred individual and different experiments.

Q. At about what time did they reach a successful solution of this problem they were working on; do you remember about the date? A. Yes, they obtained a successful conclusion and solution to that project or problem in October of 1944 .

Q. Will you tell us briefly how that first tape of this type was made? A. The tape was made with a pliable and stretchable plasticized polyvinyl chloride-vinyl acetate film backing; in other words, they utilized a vinyl chloride-vinyl acetate copolymer resin, namely, VYNS. That resin was plasticized with a non-volatile, non-migrating plasticizer comprising Paraplex G-25 and dioctyl phthalate. The film backing was primed and coated with a pressure-sensitive adhesive.

53 Q. I understand this tape was later made commercially; is that correct? A. Yes, it was. It was sold in 1945 and formulations substantially the same as that have been sold continuously up to the present time.

• • • • • • • • • • •

54 Q. Mr. Tierney, just before adjournment we were speaking of sales in 1945 of this tape. Do you know the approximate dollar value of sales during that first year? A. Yes, the approximate dollar value of that tape that was sold in the year 1945 was $10,000.00.

• • • • • • • • • • •

55 The general practice previous to the Oace inven-
56 tion was to use the only insulating tapes available at that time, for insulating the splice. These tapes were the ordinary rubber electricians' tape and the friction tape. The splice was first wrapped with the rubber insulating tape, and then over-covered or over-wrapped with friction tape or bicycle tape as some of us might recall it.

• • • • • • • • • • •

65 . . . . I'll demonstrate the prior practice, which would be to take off a piece of the rubber electricians' tape anywhere from six to eight inches in length. The electrician would first have to pull off the Holland cloth liner, and you will notice that as I just removed the Holland cloth liner, there was a threaded piece of the liner left on the electrical tape, which the elctrician would remove because otherwise, since that coating is starched, if moisture is present it would yield a conductive portion which would be undesirable on the splice. He would then take the piece and leave about a quarter of an inch beyond the end of the twisted copper portion, fold the electricians' tape
66 together, and then pulling the tape and stretching, wrap it spirally around the wire. He would next take a piece of friction tape of approximately the same length in order to yield the overwrap. As I mentioned before, the purpose of the friction tape is to yield mechanical protection to the splice. In using the product of the Oace patent, the same length piece, six to eight inches would be removed, and the piece applied, leaving about the same length beyond the twisted copper wire. Then twisting and stretching the tape around the twisted wire with just a single piece of tape, would leave noticeably a much smaller spliced portion with this one piece of tape. Now, that splice satisfies the electrical codes. A licensed electrician, in order to obey the codes, is required to use a rubber electricians tape and the overwrap of the friction tape. With the patented tape of the Oace patent, the single plastic tape wrapping satisfies the code. It lends both the adequate electrical insulation protection as well as the protection mechanically against abrasion.

* * * * * * * * * *

68 The rubber electricians' tape has a dielectric strength of about 350 volts per mil, that is, per thou-

sandths of an inch. The Oace patented tape, or the SCOTCH No. 33 patented electrical tape, has a dielectric strength of from 1200 to 1500 volts per mil. In other words, the plastic electrical tape, Exhibit T-4-A, is in the range of three and a half to four times as good in electrical dielectric insulating strength as the rubber electricians' tape. The dielectric strength of the friction tape is very low; it's in the range of 70 to 80 volts per mil. In other words, that small, thin, and much less bulky spliced portion that has been wrapped with the plastic tape is actually a higher and better insulated splice than even the big, bulky one there, and it remains the better insulated splice if both of those spliced pieces were to be left exposed to sunlight, rain, sleet for any appreciable time, outdoor exposure, for example.

• • • • • • • • • • •

71 Q. Was there ever any effort made by Minnesota Mining & Manufacturing Company to adopt the Schmidt disclosure for use as a splicing tape to insulate electrical joints, or to test it for that purpose? A. Yes, examples of the Schmidt patent were made and were evaluated as an electrical insulating tape.

• • • • • • • • • • •

73 The Court: While he is discussing that Schmidt patent, what do you understand claim 2 in that patent to mean with respect to the explanation you have just been giving, claim 2 and 3?

The Witness: Claim 2 refers to a plasticized polymer. Exhibit 6 was merely introduced to allow Your Honor to appreciate the physical effect produced by using the amount of plasticizer referred to in the Schimdt patent. I

74 think it will all be cleared up with the showing you of Exhibit No. 7, which is the one which is plasticized with the maximum quantity of plasticizer as referred to in

the Schmidt patent. In other words, Schmidt warns very specifically against going beyond 20 parts of plasticizer per one hundred parts of the vinyl resin, and the Exhibit T-7, which I now have in my hand, will, I think, clarify that. This film is the VYNS vinyl resin that has 20 parts of plasticizer, namely, the maximum amount of plasticizer referred to by Schmidt. Schmidt says, don't dare go beyond 20 parts, because you will be getting beyond what I am talking about. Now the purpose of showing this is to show that even with 20 parts a film that is still relatively stiff and rigid is obtained. It is not the soft, pliable, stretchable and elastic type of film such as the Oace patent is concerned with and requires in yielding the product that is valuable in the electrical insulating industry.

The other thing that is pertinent in the Schmidt patent is that while he says on page 1, column 2, in line 4, "In general, thicknesses of .001 to .004 inch or more are satisfactory," his preferred example, you will notice, is given at the lower part of page 1, starting with line 49, and that

preferred example uses a backing containing 100
75 parts of gamma polyvinyl chloride, 5 parts of dioctyl phthalate, and 2 parts of the monoester consisting of glycerine and cottonseed fatty acid.

In other words, there is only 7 parts of plasticizer that he used in his preferred example, but we just saw how brittle and stiff the maximum amount of 20 parts, the physical character that it gave to the vinyl film.

Now the next pertinent thing about the Schmidt preferred example is given on page 2, column 1, line 1, where it says: "The transparent film produced is about .002 inch thick as stripped from the drum before the completion of its revolution." In other words, while Schmidt talks about films that are from 1 to 4 mils, or .001 inch to .004 inch

thick, his preferred example is only 2 mils thick, and he's concerned about a transparent product. So it's quite obvious that what he is thinking about there is a product similar to the cellulose acetate pressure-sensitive adhesive tape, or the Cellophane types, which are not the stretchable, elastic type and are so thin that, if used for electrical purposes, they would not yield the high dielectric strength as given by the Oace product in thicknesses of 4 to 20 mils thickness.

• • • • • • • • • • •

76 Q. Mr. Tierney, do you find in the Schmidt patent any disclosure whatever that concerns electrical insulation? A. No, there is nothing mentioned in that patent toward that end objective.

The Court: What do you suppose is meant by what is said on page 2, column 1, beginning with line 12 and ending with 16?

• • • • • • • • • • •

The Witness: Yes, I have it, sir. That merely specifies the physical character of the tape resulting from
77 the quality of the rigid polyvinyl chloride material proper.

• • • • • • • • • • •

86 A. You will see that the Exhibit (T-13) illustrates the offsetting of the gooey, sticky adhesive onto the back side of the underlying convolutions in unwinding the roll. The originally firm pressure-sensitive adhesive has become physically soft and gooey and stringy or pasty, and where that section of the patent, Column 2, Line 39, that is, of the Oace patent reissue 23,843 refers to pasty, this Exhibit properly illustrates that pasty condition of adhesive that is obtained when the liquid type plasti-
87 cizers that have been used to the amount of from 30 to 40 parts of 100 parts of the vinyl resin film,

that when pressure-sensitive adhesives are coated on such dioctyl phthalate plasticized films, the adhesives absorb the oily type of dioctyl phthalate plasticizer and in the process becomes soft and gooey.

Q. Now Mr. Tierney, disregarding the question of the pe tiness, the soft and gooey feature, does it have the stretchability feature? A. Yes.

Q. And it has flexibility, obviously? A. Yes, it's very evident that this film (T-13) has the physical attributes of stretchiness and retractability, but it has failed in the respect that there is not perfect equilibrium obtained. The plasticizer, the liquid type plasticizer has migrated from the backing into the adhesive, making it very soft and gooey, and valueless.

• • • • • • • • • • •

89 . . . So the way Schmidt is going to avoid the difficulties that others have found in attempting to put a pressure sensitive adhesive on a soft pliable flexible and stretchable plasticized polyvinyl film backing, is first of all not to use any more than 20 parts and then finally to use a special type of pressure sensitive adhesive which he recommends, . . .

• • • • • • • • • • •

90 Q. To your knowledge, has any film constructed
91 according to the full teachings of the Schmidt patent, ever reached the commercial world? A. To my knowledge, no tape of the Schmidt patent type has ever been commercially sold in the United States.

• • • • • • • • • • •

96 The patent there points out (col. 3, l. 20) that to achieve the desired degree of stretchiness in the plasticized vinyl resin film a combination of modifiers

is recommended, a liquid low molecular weight modifier along with a high molecular weight modifier. They mention one low molecular weight liquid plasticizer, such as dioctyl phthalate, and they mention Paraplex G-25 as an example of the high molecular weight plasticizer.

* * * * * * * * * *

97 Q. Now, Mr. Tierney, when you blend together 20 parts, for example of dioctyl phthalate, which we have referred to as the DOP, with an equal or greater weight of the G-25, as referred to in the portion that you have read from the patent, what is the general nature of that plasticizer material? A. It is a liquid non-volatile plasticizer; it's a resinuous plasticizing liquid.

98 Q. Is it less viscous than the Paraplex G-25 alone would be without the addition of this DOP? A. Yes, it is less viscous and more fluid than the separate Paraplex G-25 alone.

* * * * * * * * * *

102 Ethyl acrylate polymer, or ethyl acrylate polymerized resin, is a blend of a number of different molecular weights of the ethyl acrylate unit. It has two, five, twenty, or thirty units of the ethyl acrylate monomer, or it can have eighty to a hundred or more. The composition that it has is controllable by the organic chemist, the polymerization chemist; he tailors it to produce the ethyl acrylate polymer resin of the properties that he wants for the purposes involved.

* * * * * * * * * *

103 Q. Well, can a viscous liquid polymerized ethyl acrylate be divided into a low molecular-weight fraction and a high-molecular-weight fraction? A. Yes, very definitely you can fractionate the polymerized resin into

a low-molecular-weight liquid fraction and into a higher-molecular-weight liquid fraction, more viscous resinous fraction.

Q. Well, is it correct to characterize it as a blend of the lower-molecular-weight and the higher-molecular-weight materials forming a single plasticizing material; that is, I am speaking, of course, of this polymer, ethyl acrylate. A. Yes, it is proper to refer to the ethyl acrylate polymerized resin, as it is referred to in this patent, as the blend of low-molecular-weight liquid material along with higher-molecular-weight viscous resinous ethyl acrylate.

* * * * * * * * * * *

104 Q. Am I to understand you increased the amount of the polymerized ethyl acrylate to the point that you used it as the sole plasticizing material in some of the tapes you have made?

105 A. Yes, sir, I followed the instructions in column 5 that I have referred to earlier and I made samples of stretchable plastic tape wherein the ethyl acrylate polymerized resin was used in greater amounts than the Paraplex G-25, and, namely, to the extent where it was used as the sole plasticizer.

Q. How did you proportion it with the vinyl polymer? A. The formula was 100 parts of VYNS vinyl copolymer resin, 50 parts by weight of ethyl acrylate polymer resin.

Q. I wish you would produce the sample of the 50 part ethyl acrylate and the 100 part VYNS, that is, the vinyl copolymer material; if you have it here, produce it, please, and make an explanation of its characteristics? By the way, in order to keep the record straight, I would like to identify this at this point as Tierney Exhibit 14, so that you can refer to it as that and keep it straight. A. The roll

of tape I now hold in my hand represents that tape to which I have just been referring. It is Plaintiff's Exhibit No. T-14, namely, the backing where the vinyl resin was the 100 parts VYNS combined with 50 p rts of the ethyl acrylate resin. You will notice that the tape is stretchy, that is is soft, pliable, conformable; that pressure-sensitive adhesive that has been coated on it has no tendency to offset to the

106 underlying layer in unwinding; that the tape has aggressive adhesive character; that it can be applied to smooth surfaces and it will adhere, removed therefrom and leave no residue. Now that film backing was 100 parts of the VYNS resin, 50 parts of the ethyl acrylate polymer resin, 3.6 parts of calcium stearate. It was blended and milled according to the method described in the patent in Example 1, in column 6. It was sheeted to a 4-mil thickness. The backing was primed with a primer described in Example No. 2, and it was coated with the pressure-sensitive adhesive described in Example No. 2 of the Oace patent. It is a stretchable and retractable electrical insulating tape. It was tested for its electrical insulating character, and found to have a dielectric strength of over one thousand volts per mil. You will recall that the rubber electrician's tape has only 350 volts per mil and the friction tape only about 80 volts per mil.

Q. Was it tested for its aging characteristics? A. Yes, it was, and it is a stable, long-aging type of stretchable pressure-sensitive plastic film backing electrical insulating tape, that is, where the adhesive is in permanent equilibrium with the backing.

* * * * * * * * * *

107 A. Yes. That section, starting with line 45 and ending at line 64, refers to the fact that the resinous or high-molecular-weight modifiers, such as the Paraplex G-25, are capable of producing the desired degree of stretch and

elasticity in the vinyl chloride polymer films, and, furthermore, that they are generally classified as non-migrating or permanent type modifiers or plasticizers; however, that it is surprisingly found that the material such as G-25 does not provide for permanent equilibrium of adhesives and backing, as was defined earlier in column 3 of this patent, and that when tapes were made of the vinyl polymer and such Paraplex G-25 resinous modifier and coated with pressure-sensitive adhesives, that they had a tendency to lose a great deal, if not all, of their initial tackiness or pressure-sensitivity and that when tape made that way was un-

108 wound from roll form after only a moderate period of storage it did not adhere, because of this loss of the pressure-sensitive adhesiveness, or the loss of tack that is referred to there.

• • • • • • • • • • •

A. I believe the patent there refers to what the experience of Oace, Eastwold and Snell was as of that period of time with the Paraplex G-25 of that vintage, namely, 1944, 1945.

Q. Were you acquainted with the results that are stated in that portion of the specification at the time this work was done by those inventors or by those researchers? A. Yes, I was.

109 Q. And it is accurately stated, according to your memory? A. It accurately states what the experience of the three patentees was with reference to the use of the Paraplex G-25, as it was made and composed and sold at that time by the Resinous Products & Chemical Corporation, which was the subsidiary of Rohm & Haas.

• • • • • • • • • • •

111 . . . . Sir, that was not the bad condition that was obtained with the use of the Paraplex G-25 as to a

plasticizer at that period, in '44 and '45. The bad result that was obtained was the pressure-sensitive adhesive lost its adhesive aggressiveness within one or two days.

Q. As distinguished from becoming pasty? A. Yes. Now, with the use of Paraplex G-25 as it has been made and furnished to the trade in the last two years or
112 three years, that same result has not been obtained. A pressure-sensitive adhesive and retractable insulating tape of satisfactory aging life is obtained with the use of Paraplex G-25 of recent vintage, that is, as it has been made within the last two or three years. There is nowhere that same amount of tack-killing or adhesion loss obtained with the Paraplex G-25 plasticizer of recent vintage. It is true that there is still a relatively small amount of tack loss when Paraplex G-25 of recent vintage is utilized as the sole plasticizer. Better results are still obtained today with Paraplex G-25 of recent vintage when a small amount of the DOP or dioctyl phthalate is added to its as the plasticizing ingredient.

Q. Does the patent indicate generally the chemical nature of the product that's sold under the trade designation of Paraplex G-25? A. Yes, that is indicated in column 5, line 26 to line 30, where it indicates that it is the reaction product of sebacic acid with glycol, or polyhydric alcohol.

Q. How would you describe the general characteristics of that material? What kind of material is it? A. It is a liquid viscous resinous material.

Q. Does it have a varying molecular weight? A. Yes, it is composed of a range of varying molecular weights.

• • • • • • • • • • •

118 Q. Now, as a practical matter, has the commercial product of your company generally responded to

those properties that we have just discussed? A. All of the plastic pressure-sensitive insulating tape that has been manufactured and sold by Minnesota Mining and Manufacturing Company fully answers those specifications or those characteristics that we just referred to.

* * * * * * * * * * *

123 . . . It (col. 4, l. 63) indicates that in that instance, with that particular copolymer resin the vinyl chloride is in the proportion ratio of 95 parts to 5 parts of the vinyl acetate, and in that same section it indicates that the polyvinyl chloride itself, that is, in the ratio of 100 parts to zero parts of the vinyl acetate, is satisfactory.

Q. I suppose what you are referring to is that language which says "Vinyl chloride itself is satisfactory in many formulations"? A. Yes. That is line 65 to 67, column 4 of the patent.

Q. Now has your company ever made and sold commercially a product, that is, a plastic tape of the type we are discussing, with a backing material made of straight vinyl chloride polymer, suitably plasticized, that is, other than the copolymer? A. Yes, we have made and sold a considerable amount of such stretchable insulating pressure-sensitive adhesive tape.

Q. And you have found that to be a satisfactory commercial product? A. Yes.

* * * * * * * * * * *

124 A. That paragraph (1st of col. 5) refers to the fact that other liquid plasticizers, other than the dioctyl phthalate, may be utilized; however, that the plasticizer must be compatible with the vinyl polymer and that it should be low in volatility; that is, that it should not evaporate over a period of time; and, by being compatible, it is

required that the plasticizer shall be homogeneously incorporated with the vinyl resin; it should not spew out or exude onto the surface of the plasticized vinyl film; and that, in addition, that low volatility is an important point so that the plasticizer will not be driven off during the milling and the calendering, because those two manufacturing operations are conducted at high temperature, namely, temperatures of from 250 degrees F. up to, and in some cases, 320 degrees F. It indicates some liquid plasticizers, such as tricresyl phosphate, dioctyl phthalate, that are alternate materials for the DOP. It also indicates in line 11 to line 15, column 5, that all of those compounds such as the ones specifically mentioned are capable of producing pastiness in the water-insoluble, pressure-sensitive type adhesives that are coated on the vinyl backings which are plasticized with those specific liquid plasticizers mentioned in that paragraph, if those liquid plasticizers are used in proportions greater than about 20 parts per hundred
125 parts of the vinyl polymer.

Q. Now, taking the first sentence of the next paragraph that begins in line 16, this reads: "Likewise, various compatible non-migrating resinous or high molecular weight modifying materials having a plasticizing effect on the vinyl polymer employed may be substituted in whole or in part for the specific alkyd resin hereinbefore mentioned." What is, in your interpretation, the specific alkyd resin that's been mentioned? A. The specific alkyd resin that's been mentioned in the patent prior to this section is the Paraplex G-25.

Q. What is the significance of the statement that I have read to you? A. The patent states that various other compatible, non-migrating resins or high-molecular-weight materials that have a plasticizing effect on the vinyl poly-

mer may be substituted in whole or in part for the specific alkyd resin, namely, the Paraplex G-25 that was mentioned earlier.

• • • • • • • • • •

134 A. Yes, Minnesota Mining and Manufacturing Company has sold a considerable quantity of stretchable pressure-sensitive insulating tape that corresponds essentially to example 1, with the exception that instead of using the specific primer of the example 1, the greatest majority of all of the plastic tape sold by Three M company has utilized a primer essentially the same as the primer that is specified in example 2 of the patent, and the last exception is that the greatest majority of the plastic tape has been sold by Three M Company, has been of the black backing or the same as the plasticized film of example 1 of the patent except for the fact that .5 parts of carbon
135 black were added to the 100 parts of the VYNS resin.

• • • • • • • • • •

143 Q. Now I think generally we've covered the patent. I have some other questions now. Has the material that is sold by Rohm & Haas, and was sold by them under the trade designation of Paraplex G-25, undergone any observable change over the years, that is, from the time it was first brought to the attention of your company? A. Yes it has. In 1944 to 1945 the Paraplex G-25 that we received, had a film of oil on the surface of the containers, and the Paraplex G-25 which we have received in recent years, has had no such liquid oil on the surface of the containers as we receive it from Rohm & Haas Co.

Q. Now is there any other difference between the recent supply of this Paraplex G-25 as compared with that furnished to your company by Rohm & Haas in the year 1945?

A. Yes, the observable difference that today when we utilize the current vintage type of Paraplex G-25, we can make a satisfactory stretchable and retractable pressure-sensitive adhesive tape, with it as the sole plasticizer. We had no success in doing that in the period 1944 and 1945 because

144 such tape as was made with the Paraplex G-25 of that vintage, lost its pressure-sensitive adhesiveness within one or two days after the tape was made. The present Paraplex G-25, while it shows some loss of adhesiveness, it's nowhere near of the same order. The amount of pressure-sensitive adhesiveness that is left with the tape made with the Paraplex G-25 of current vintage, is sufficient for adequate splicing and adhesion for many months. Now, I indicated before, I believe, that a superior tape is still made if some dioctyl phthalate is added to the Paraplex G-25 of current vintage, to provide a non-migrating plasticizer for the vinyl polymer resin in making the stretchable and retractable electrical insulating tape of the patent.

• • • • • • • • • • •

149 If the specification range of Paraplex G-25 were to be narrowed, that is, if the viscosity range of it were to be narrowed, in my opinion that would signify that they had produced a more narrow controlled range of molecular weight material. If a resin has too high a molecular weight, that is, if the molecule is too large, it is very difficult to squeeze it into the vinyl resin and have it act as a plasticizer, by the sheer virtue of its being too large, . . .

• • • • • • • • • • •

151 A. In my opinion, if the higher-molecular-weight portions were removed, the Paraplex G-25 would be a more satisfactory plasticizer for the vinyl resin. There would be less tendency for any of the higher-molecular-

weight material to exude on the surface of the viynl film. The elimination of the portions that were of higher molecular weight would minimize that tendency, or, in other words, would make for a more homogeneously incorporated plasticizer, one that would have less tendency to exude or spew out.

Q. In the years 1944-1945 did representatives of Rohm of Rohm & Haas Company call on your company in connection with business matters? A. Yes, they did. Dr. Fred Meyers and Mr. Martin Bretl called on us at that time and have continued to call on us up to the present time.

Q. In the years 1944-1945 were representatives of Rohm & Haas acquainted with your problems in development work? A. They knew that we were attempting to use their material as a plasticizer for vinyl resin in the manufacture of a stretchable pressure-sensitive adhesive tape.

Q. Were you at that time informed by any of the representatives of Rohm & Haas that they did have processes and means for controlling the molecular weight of
152 their polymeric resinous products such as Paraplex G-25? A. Yes. Dr. Meyers so indicated at that time.

Q. Did this relationship between your company and Rohm & Haas continue; that is, did they continue to call on you throughout the years following the period that we are interested in? A. Yes, those two same representatives, along with others, have frequently called on Minnesota Mining and discussed the performance of their products in the manufacture of our products in which we used their materials.

Q. During that period did you discuss your problem with any other organization other than Rohm & Haas? A. Yes,

I discussed the subject with Bakelite Corporation, which is a subsidiary of Carbide and Carbon Chemical Corporation.

Q. Do you recall any individuals that were associated with that company, the Bakelite Company, that those discussions were had with? A. Yes, sir, I remember specifically a discussion I had with Mr. Intemann in New York City in 1945; Mr. Arnie Sward was also present in that discussion.

Q. Was there any disclosure made of the formulation of the backing to the Bakelite Company or to others, as of the period about the time the application was filed?

153 A. Yes, we disclosed our formulation for making the plasticized stretchable and retractable vinyl resin film that performed satisfactorily in making the pressure-sensitive insulating tape of the Oace patent. That formula was disclosed to Bakelite Corporation by Dr. W. E. Lundquist in March of 1946.

• • • • • • • • • •

156 Q. Did the Bakelite Company ever produce films for your company in general accordance with the formula? A. Yes, they did. They produced quite a few thousand square yards of plasticized vinyl resin film

157 in accordance with the formula which we gave to them and asked them to use in making such film for us.

• • • • • • • • • •

159 The Court: If I understood you correctly, in this product sold under the number 33, SCOTCH brand, the volume was in excess of eight million square yards?

The Witness: Yes.

The Court: And that constituted about fifty per cent of your product?

The Witness Yes, fifty-seven per cent of all our—

The Court: Fifty-seven?

The Witness: Yes.

The Court: Then your product under sale number 22, as I understood you, that embraced something in excess of three million square yards?

The Witness: Yes.

The Court: Do you have the percentage there?

The Witness: Yes.

The Court: What is it?

The Witness: The combination of those two types—

The Court: I mean on number 22. What is the percentage of your volume?

The Witness: Oh, twenty-three per cent of the total volume of tape.

• • • • • • • • • •

163 Q. Mr. Tierney, at lunch, it was suggested that your answer with respect to where you found the oil on the Paraplex G-25, that is, that you got around 1944 and 1945, will you make a statement of what the fact is? A. The fact is that the layer of liquid oil was on top of the Paraplex G-25 itself.

• • • • • • • • • •

165 Q. Now before you testify in regard to that, I would like to give it a number, Exhibit 17 for identification. T-17. What is the ratio in this blend of the G-25 and dioctyl phthalate? A. The ratio in this blend of liquid resinous plasticizer for the G-25, is 2 parts to 1 part of the DOP. In other words, this plasticizer represents the plasticizer of example 1 of the patent wherein there is the 200 parts of Paraplex G-25 and 100 parts of dioctyl phthalate.

Q. What is the nature of the material? Can you demonstrate it? A. It is a soft viscous resin liquid in character.

The Court: To the ordinary observer it looks like mucilage. A. Yes, sir. It is a non-volatile plasticizer, non-migrating plasticizer.

* * * * * * * * * *

166 Q. Now, taking this blend of the material that you just spoke of, how does it function as a plasticizer? A. It functions in purely a physical sense in making the hard, horny, non-elastic vinyl resin or vinyl copolymer resin soft, pliable, flexible, stretchable and elastic.

The Court: What about retractable. A. And retractable also.

Q. Now Mr. Tierney, have you an example of the material known as the polymerized ethyl acrylate? A. Yes I do.

Q. All right, the bottle that is before you, I ask to be identified as Exhibit T-18. Now, what's the nature of this material? A. This is a soft viscous resinous ma-
167 terial, somewhat more viscous than the Exhibit 17 that I just talked about. It is a high molecular weight resinous material.

Q. Well, how does its physical characteristics compare with a plasticizer of the material that is contained in Exhibit 17, which was the G-25 plus the DOP? A. It is a liquid material, somewhat more viscous in character than Plaintiff's Exhibit T-17.

* * * * * * * * * *

Q. Now how does this polymerized ethyl acrylate (Ex. T-18) function in making the tape of the Oace patent? A. The polymerized ethyl acrylate resin also functions in purely a physical sense in making the hard brittle vinyl polymer resin soft and pliable, elastic, stretchable and retractable.

Q. If you recall, we entered those as T-14, a tape that was made as I understand it, with the polymerized ethyl acrylate. Was it a material such as is exemplified by what is contained in this bottle, T-18, the material with which that was made? A. Yes it was. Exhibit T-14 represents the tape which was made with the ethyl acrylate polymerized resin of Exhibit T-18, where 50 parts of that polymerized ethyl acrylate resin of the same material in Exhibit T-18, was used to plasticize 100 parts of VYNS vinyl copolymer resin.

* * * * * * * * * * *

170 A. The Paraplex G-40 resinous plasticizer also functions in a purely physical sense in making the hard, brittle vinyl resin soft, pliable, stretchable and retractable. There is, in other words, no chemical sort of reaction involved in achieving that plasticizing of the vinyl resin.

171 In making the tape, Exhibit 19, where the Paraplex G-40 was used as the sole plasticizer, the same procedure was followed as was referred to in the Oace patent, except for the substitution of the Paraplex G-40; the same mixing equipment and milling and calendering procedures were utilized and the same result was obtained; that is, the finished plastic electrical tape obtained, Exhibit T-19, was indistinguishable from the Oace product, from the Exhibit T-4-A.

Q. Now have you a sample of the tape that was made with the G-25 of the current production, that is, of the current vintage, as the sole plasticizer? A. Yes, I do.

Q. I believe that is identified as Exhibit T-21 and so marked? A. Yes, it is. The roll of tape I now hold in my hand, Exhibit T-21, represents the stretchable plastic in-

sulating tape where Paraplex G-25 has been used as the sole plasticizer, that is, the Paraplex G-25 of current vintage. It was used to the extent of 50 parts of the Paraplex G-25 to 100 parts of the Vinylite VYNS copolymer resin, along with the 3.6 parts of calcium stearate stabilizer and the .7 parts of carbon black.

* * * * * * * * * * *

172 Q. How does this tape that you have before you now compare in physical characteristics with the other tapes we have been discussing? A. It has the same physical characteristics. It is stretchable, pliable and retractable. The pressure-sensitive adhesive remains in permanent equilibrium with the backing. The tape is a high quality, high dielectric strength electrical insulating tape. The tape is indistinguishable from the other examples of tape so far introduced. The electrician could not tell that tape apart from Exhibits T-4-A, T-14, T-19.

* * * * * * * * * * *

173 A. Yes. The bottle sample that I now have in front of me represents G-25 of current vintage? It is Exhibit T-22.

* * * * * * * * * * *

Q. Can you indicate the characteristics of it as to viscosity and so forth? A. It is a liquid, viscous resin. As I turn the bottle on its side, you will notice that its viscosity is somewhat higher than the viscosity of the Paraplex G-40, but it is liquid and viscous and it is resinous.

* * * * * * * * * * *

A. The Paraplex G-25 in Exhibit T-21 functions in the same manner, namely, the same physical sense, in
174 making the hard, brittle vinyl copolymer resin soft, pliable, stretchable and elastically retractable. The

pressure-sensitive insulating tape of Exhibit T-21, from a critical standpoint, might be stated as not quite the same in quality of retaining pressure-sensitive adhesiveness upon aging, as I believe I made reference to earlier in my testimony, that there was still more of a tendency for losing some of the pressure-sensitive adhesiveness with the G-25 than with the plasticizer of Example 1 of the patent, or than with the G-40 plasticizer, for example. However, that amount of loss of pressure-sensitive adhesiveness was in no wise near the amount that was recognized in the use of the Paraplex G-25 of 1944 or 1945 vintage, where pressure-sensitive adhesiveness was completely killed in a matter of only one or two days. Tape of Exhibit T-21 will retain adequate pressure-sensitivity for a period of a year and be suitable for making satisfactory splices by the electricians in the trade.

• • • • • • • • • • •

175 Q. Now, Mr. Tierney, in summary, you have talked about these four different plasticizers and talked about the tapes made respectively of each (G-40 tape, Exhibit T-19; G-25 and DOP tape, Exhibit T-4-A; ethyl acrylate tape, Exhibit T-14; and current vintage G-25 tape, Exhibit T-21). Will you, just in a general way, compare them? A. They are the same tape, and would be recognized by the electrician as the same tape. All four of them have the same physical quality of stretchability and retractability. On all four of the examples the pressure-sensitive adhesive remains in permanent equilibrium with the backing. All four of the tapes are high quality, high dielectric

insulating strength tapes. They are all four electrical insulating tapes.

Q. Now there has been some discussion about this dioctyl phthalate, or known as DOP for short. Have you a sample of that material? A. Yes. The bottle sample now in front of me, marked Exhibit T-23 is DOP, or dioctyl phthaalte. As I turn the bottle on the side, you will see that it is a relatively fluid material, having about the consistency of a liquid mineral oil, Nujol, somewhat more viscous than water, but relatively less viscous by a good deal than the Paraplex G-40 or the Paraplex G-25.

* * * * * * * * * *

176 Q. Have you analyzed this G-25, current G-25, to determine the range of molecular weights? A. Yes, I have had such current-vintage Paraplex G-25 analyzed for its percentage composition of the different molecular-weight fractions.

Q. Do you remember the range? A. Yes. The molecular weight ranges from one thousand to approximately fifty thousand.

Q. Now, with respect to this G-40, have you fractionated it into low-molecular-weight and relatively high-molecular-weight fractions? A. Yes, I have had such fraction percentages also taken on the Paraplex G-40 of modern vintage manufacture.

* * * * * * * * * *

177 A. Yes, T-20 is the Paraplex G-40 itself, as it is sold by the Rohm & Haas Company. Exhibits T-24 and T-24-A represent the fractional parts of the original Paraplex G-40 that is represented by Exhibit T-20. In other words, in this bottle, namely, Exhibit T-24, we have 67 per cent, which is the more viscous, higher-molecular-weight

resinous portion of the Paraplex G--40, or the Paraplex G-40 as represented by Exhibit T-20. Exhibit T-24-A represents 33 per cent of the original Paraplex G-40, which is the more liquid, lower-molecular-weight part of the original Paraplex G-40. If I add these two bottles together and homogeneously mix them, that is, the Exhibit T-24
178 and the Exhibit T-24-A, I get six ounces, exactly the same thing that I have in Exhibit T-20; I get the original Paraplex G-40 back again.

• • • • • • • • • • •

Q. Mr. Tierney, how does the higher-molecular-weight fraction contained in the bottle marked Exhibit T-24 compare in viscosity and other physical characteristics with the Paraplex G-25 of recent purchase, exemplified by the material in Exhibit T-22? A. It is a soft, viscous resin of about the same viscous nature as the Paraplex G-25, perhaps a little more viscous in its character than the straight Paraplex G-25.

• • • • • • • • • • •

179 Q. Now is the liquid fraction, that is, the material exemplified by the material contained in the bottle marked T-24-A, a plasticizer? A. It is.

Q. Is it an ester plasticizer? A. Yes, it is.

Q. And is it a liquid ester plasticizer? A. Yes, it is.

Q. Is it a liquid phthalyl plasticizer? A. No.

Q. Well, what is it? A. It's a liquid adipyl plasticizer.

Q. What is the relationship between a liquid phtalyl ester plasticizer and an adipyl ester plasticizer? A. They are both plasticizers; they are both esters of organic dicarboxylic acids; they are both liquid; they are both non-volatile.

• • • • • • • • • • •

180 A. When the liquid material of Exhibit 24-A is mixed with the soft viscous resinous portion of Ex-

hibit T-24, a non-migrating plasticizer blend is produced which when used in the same manner as the procedure indicated in example No. 1 of the Oace patent, it produces the same end results and the same product, namely, the stretchable, retractable plastic film backed electrical insulating tape, with pressure-sensitive adhesive in permanent equilibrium with the backing.

Q. Well now, what conclusions do you draw in respect to the similarity or difference in function between this liquid ester fraction of Exhibit 24-A when combined with a high molecular weight fraction from Exhibit T-24 as compared with the function of a liquid phthalyl ester plasticizer when combined with a high molecular weight Paraplex G-25 in current production? A. The conclusion that I draw is that the same function is obtained in both cases, and the same end result is obtained by the same method of blending and procedure. In the mixing of the low molecular
181 weight, ester plasticizer of Exhibit T-24-A, with the viscous alkyd resin plasticizer of Exhibit T-24, a plasticizer is obtained that gives essentially the same function as the combination of the Paraplex G-25 in the ratio of 2 parts to 1 part of DOP. Now, that same result is obtained by using the two parts of the viscous resi ous material of Exhibit T-24 with 1 part of the liquid low molecular weight ester of Exhibit T-24-A.

* * * * * * * * * *

A. Yes, I have had Paraplex G-25 of current vintage fractionated in the same manner as utilized in the fractionation of Paraplex G-40, and the two bottles that are now in front of me, namely, Exhibit T-25 and Exhibit T-25-A, represent the results of that fractionation. You will notice that this time the amount of the low molecular weight liquid fraction is about half that amount that was fractionated

from the Paraplex G-40. In this case, with the Par-
182 aplex G-25, the liquid fraction of low molecular weight that was separated from the original Paraplex G-25, amounted to approximately 12% of the original Paraplex G-25. That 12% portion of liquid material is represented by Exhibit T-25-A, and as I turn the bottle on its side you can see its liquid character. The Exhibit T-25 represents the viscous higher molecular weight resin portion, namely, 88% of the original Paraplex G-25.

* * * * * * * * * * *

183 Q. Now, there has been a discussion about these phthalyl esters, the sebacic acid esters and the adipic acid esters. What generally is the relationship between these esters? A. They are all liquid plasticizers offered in commerce, in the same grouping and referred to in the literature in the same groupings. They are each the ester of a di-carboxylic acid, namely, the phthalyl ester is the ester of the di-carboxylic phthalic acid, the sebacyl ester is the ester of the di-carboxylic sebacic acid and the adipyl ester is the ester of the di-carboxylic adipic acid.

Q. Well, when you speak of an ester, have you defined that? A. I don't recall whether I have or not. It is the reaction—it is the product of the reaction of an al-
184 cohol with an organic acid, namely, an hydroxy compound with an organic acid that has the COOH group, which is referred to as the carboxylic acid group.

Q. Now these esters that we have just discussed, are they known to be useful in the art as plasticizers for vinyl chloride polymers and other synthetic resins? A. Yes they are.

Q. Now, how do these three that we have spoken of, the phthalyl ester, the sebacic ester and the adipyl ester compare as plasticizers? A. They all function in the same way

in producing soft pliable, stretchable and elastic plasticized polyvinyl resin films.

Q. You have referred to the fact that the classification of these esters together has been referred to in literature. Have you any literature references? A. Yes I do.

Q. To support that statement? A. Yes I do.

* * * * * * * * * *

189 Q. Mr. Tierney, you've already introduced and identified the polymerized ethyl acrylate as the complete material. Did you fractionate that material? A. Yes I did.

* * * * * * * * * *

190 A. Exhibit T-26-A represents the liquid or low molecular weight fraction of the original polyethyl acrylate polymer resin, exemplified by Exhibit T-18. It represents, in short, 28% of the ethyl acrylate material represented by Exhibit T-18. As you tip the bottle you will notice that although somewhat viscous in character, it is liquid and flows quite readily. Exhibit T-26 represents the higher molecular weight fraction of the original ethyl acrylate polymer resin exemplified by Exhibit T-18. This material of Exhibit T-26 represents 72% of the original ethyl acrylate polymer resin of Exhibit T-18. As I turn the bottle on its side you will notice that it is soft but quite viscous. It is a resin and has resinous character.

* * * * * * * * * *

193 A. In my opinion I believe the patent itself and the specification of the patent makes clear what is meant by the term: "Major proportion" because the definition of it has been given in that section I just quoted from column 4, lines 58 to 66 of the patent, namely, that the major

proportion can extend to the 100 parts, to zero parts of the other material.

• • • • • • • • • • •

A. That the plasticizer should contain that proportion of a "non-migrating viscous plasticizer resin".

• • • • • • • • • • •

197 Q. Will you state whether or not in the accused Plymouth tape there is a stable blend of the vinyl chloride-vinyl acetate and the backing member? A. Yes, there is. The record shows that the polyvinyl resin utilized by the Plymouth Company in the manufacture of their plastic electrical insulating tape is the VYNW type, namely, the 95:5 vinyl chloride-vinyl acetate copolymer. It is a stable resin.

Q. Is the same thing true of the backing member of the TUCK tape? A. Yes. The record shows, I understand, that Tuck Company also uses the VYNW type of vinyl copolymer resin for their backing for their number 330 black plastic electrical insulating tape.

Q. Now state the fact as to whether the backing member in the PLYMOUTH tape and the TUCK tape include a copolymer of monomers. A. Yes, both the PLY-
198 MOUTH tape and the Tuck tape include a backing member that is formed of the copolymer of the monomers, namely, vinyl chloride-vinyl acetate.

Q. What is the fact as to whether the plasticizer material in the accused PLYMOUTH tape makes a stable blend with the vinyl resins of the backing? A. It does.

Q. State the fact whether the pressure-sensitive adhesive coating in the PLYMOUTH tape is eucohesive, as that term is defined in the patent. A. The unwinding of the rolls of

PLYMOUTH tape demonstrates that the pressure-sensitive adhesive coating has eucohesive character, in that its cohesive strength is higher than its adhesive strength, and the adhesive coating is aggressively tacky.

Q. State whether the pressure-sensitive coating on the TUCK vinyl plastic tape is eucohesive in the same sense. A. The adhesive coating on the TUCK tape is also eucohesive in that same sense, namely, that the adhesive coating has higher cohesive strength than its adhesive strength.

Q. What is the softening temperature of the copolymer vinyl chloride-vinyl acetate, the major proportion of
199 which is vinyl chloride, as employed in the accused PLYMOUTH tape and also in the TUCK tape? A. The softening temperature of the vinyl copolymer resin utilized in the PLYMOUTH tape and the TUCK tape is about 280 degrees F.

Q. What is the fact as to whether the copolymer of vinyl chloride-vinyl acetate used in the backing of both of those films is insoluble in water, or substantially so. A. It is insoluable in water; that is, the material used on both tapes for the backing member produces a material that is water insoluble in both instances.

Q. I think you have already testified that a copolymer vinyl chloride-vinyl acetate plasticized with G-40 is not normally black in color, haven't you; or what is the fact? A. The fact is that the vinyl chloride-vinyl acetate copolymer resin itself, plasticized with G-40, is transparent and colorless, or very slight amber in transparency. The black color of the tape backing used for the PLYMOUTH tape, the TUCK tape, and the SCOTCH brand number 33 and number 22 plastic electrical tapes results from the addition of a very minor amount of carbon black as an opaci-

fying pigment, namely, about .5 to one and a half parts to 100 parts of the vinyl resin.

200 Q. What causes the black color of the G-40 tape of PLYMOUTH; that is, assuming the use of G-40? A. The black color is caused by the addition of carbon black pigment in minor amounts, namely, .5 to 1.5 parts to 100 parts of the VYNW vinyl copolymer resin used for the backing in conjunction with the Paraplex G-40 as the plasticizer.

• • • • • • • • • • •

206 Q. Mr. Tierney, you have already testified that you have studied and are familiar with the patents and publications that were relied upon by the defendant in this case . . . A. Yes.

Q. Now will you please evaluate in summary fashion these patents and publications with respect to the Oace patents in suit?

• • • • • • • • • • •

207 A. With those deletions, it reduces the prior art citations to eleven U. S. patents—excuse me, eight—one Swiss foreign patent, and some twenty or more publications. Now in none of those patents cited nor in the publications is the method of making the product of the Oace patent in suit here, nowhere is the teaching found of how to make the Oace product. A number of the patents disclose separate parts of the Oace product. They dis-
208 close the vinyl resins, various plasticizers. Some are concerned with the problem of electrical insulation; some disclose plasticized films that are in the range of thicknesses of the film backing of the Oace product; for example, the Groff patent 1,966,856 discloses at page 4 the vinyl resins plasticized with 20 parts of dibutyl phthalate to

100 parts of the vinyl resin and that is formed into thin sheets that vary from .004 up to .2500 inch in thickness; in other words, that is a film of 250 mils in thickness. So that they cover the Oace range of thicknesses, both above, well beyond, as well as thinner.

Now the Groff patent was applied for August 10, 1931, and patented July 17, 1934. So that shows that the vinyl resins and the films of them were available.

Q. May I stop you there just a moment. The plasticizer in connection with that Groff patent is the same character of plasticizer that was used by Schmidt that you discussed during the discussion of the patent, is it not? A. Yes, that's right. That's the migrating type of plasticizer, such as the dibutyl phthalate, the halogen agent, as referred to in the Groff patent, page 2, column 1, lines 3 down to line 11, tricresyl derivatives. There was not the compatible type of non-migrating plasticizer of polymeric nature disclosed in the Groff patent.

* * * * * * * * * *

209 The publications of Rohm & Haas show that Paraplex G-20 plasticizer, a polymeric ester of sebacic acid and di- or poly-hydric alcohols, was available in 1929 and 1930. The rubber resin type of pressure-sensitive adhesives were available well before 1930. So that all of the materials were available to make the Oace product, but they waited for someone to put them together in the way that Oace, Eastwold and Snell did.

For example, one could have taken the vinyl chloride-vinyl acetate copolymer resin, such as those disclosed in the Groff patent, that were available in the early 1930's and could have plasticized it with the non-migrating, high-molecular-weight type of Paraplex G-20 resin and the dioctyl

phthalate, because dioctyl then was available and in use before 1925 as a plasticizer, and they could have blended,
mixed, milled and calendered those materials, be-
210 cause those procedures that are described in the Oace
patent for mixing, blending, milling and calendering the ingredients are, as I have stated, not new and novel. One could have produced the 4 to 20-mil thick vinyl plasticized vinyl polymeric film and he could have primed it with the earlier-art primers and the earlier-art pressure-sensitive adhesives and obtained a stable, stretchable and retractable insulating tape with the qualities of the tape of
the Oace patent in suit. But nowhere in any of these
211 prior cited patents, the foreign Swiss patent or the
twenty or more publications, was that taught prior to the time that Oace, Eastwold or Snell taught it in this patent in suit.

* * * * * * * * * *

215 Q. Has Minnesota Mining and Manufacturing
Company granted a license under the Oace patent, that is, the reissue patent 23,843 to the Johns-Manville Corporation? A. Yes, they have.

Q. Do you know the effective date of the license? A. The effective date was August 30, 1955.

Q. What rate of royalty did it provide? A. The rate of royalty is five per cent on the net sales of the product that comes within the scope of the Oace patent.

* * * * * * * * * *

216 A. I know of no other contracts in relation to this
matter that went along with this subject that were consummated, agreed to or signed.

The Court: Are you an officer of your corporation, oc-

cupying a position where, if such an arrangement had been entered into, you would have knowledge of it?

The Witness: I certainly think that with the responsibility that I have carried in the pressure-sensitive tape field I would have had some knowledge of any such other contract that would have had to do with this matter.

* * * * * * * * * *

217 Q. Now, during the month of September, under the provisions of that contract, has Johns-Manville paid a royalty? A. Yes, they have. The first royalty check, covering the five per cent royalty on the plastic tape sold by Johns-Manville Corporation within that period from August 30th to the end of September, has been received.

Q. In what amount? A. In the amount of $6,243, which indicates that, at five per cent royalty, Johns-Manville Corporation sold in the month of September over one hundred and twenty thousand dollars worth of this plastic electrical insulating tape that is the Oace patented product.

* * * * * * * * * *

Cross Examination

By Mr. Hector M. Holmes:

* * * * * * * * * *

254 Q. I mean, this polymerized ethyl acrylate is what this patent in paragraph 3, the complete paragraph refers to twice, as the "resinous type" plasticizer? * * * A. It at that point could include both because polymerized ethyl acrylate contains—it is itself a combination of modifiers. It contains low molecular weight liquid plasticizer, which is an ester material, namely, a liquid ester material, and it also contains high molecular weight resinous type plasticizer.

Q. That isn't my question. This paragraph twice refers to "resinous type plasticizers" and they mention three, Paraplex G-25 and in the same paragraph polymerized ethyl acrylate and as another example, polymerized vinyl butyl ether. Now, those are all three a resinous type of plasticizer are they not? A. They are all resinous type plasticizers and I might explain that the paragraph talks about the plasticizing of the vinyl resin and it indicates that a combination of modifiers should be utilized
255 to achieve the desired result of the patent, namely, that low molecular weight plasticizer should be combined with a high molecular weight plasticizer.

• • • • • • • • • • •

Q. Now you state that this combination of the liquid type plasticizer and the resin type plasticizer is recommended to get the desired stretch. Would it not be a little more accurate to say it is specified rather than recommended by this same paragraph and the next one? A. It is correct to say that it is specified to get the complete result of the Oace patent, namely, the complete pressure-sensitive adhesive tape of the Oace patent.

Q. Those are the instructions to use this mixture of the liquid type and the resinous type? A. The instructions are as indicated in that paragraph, to use a combination of modifiers, which includes low molecular weight liquid plasticizers together with a substantially equal or somewhat greater amount of high molecular weight resinous type plasticizer, and then the paragraph proceeds to in-
256 dicate Paraplex G-25 as a specific example of a preferred type of the resinous plasticizer, and the paragraph further indicates polymerized ethyl acrylate as useful and suitable.

• • • • • • • • • • •

262 A. Yes, they are non-migrating, but the patent, in column 3, starting with line 20, indicates that, in order to secure permanent equilibrum between the backing and the adhesive, the patent recommends that there be employed with the vinyl chloride polymer a — and I am quoting now, starting with line 23 — "a combination of modifiers including a substantial but minor amount (not to exceed about 20 parts per 100 parts of the vinyl polymer) of a low molecular weight liquid plasticizer . . . "— unquote for the moment — such as dioctyl phthalate is an example liquid plasticizer mentioned there. Now
263 dioctyl phthalate is a liquid ester of low molecular weight. I might now continue reading, after that, in line 27, quoting from the patent: ". . . together with a substantially equal or somewhat greater amount of a high molecular weight resinous type plasticizer, the amount of the latter in any event being sufficient, together with the liquid plasticizer, to provide the desired degree of stretch in the final film."

Now the patent points out there that, to get the permanent equilibrium and also the stretchiness you should utilize a combination of modifiers, one of which is a liquid plasticizer of low molecular weight, combined with a high molecular weight resinous type plasticizer. Now that language does not exclude the case where the material, the plasticizing material itself, can have both the low molecular weight liquid plasticizing material along with the high molecular weight resinous type plasticizing material, because in a separate sentence, starting in column 3, line 40: "Another high-molecular-weight plasticizer material which has been found useful in providing suitably stretchable and elastic vinyl polymer films is polymerized ethyl acrylate," and polymerized ethyl acrylate has both low-molecular-

weight liquid plasticizer and high-molecular-weight resinous plasticizer in it, in the same material, in much the same way that Paraplex G-40 has both the low-molecular-
264 weight liquid plasticizer present in it along with the high-molecular weight resinous plasticizer.

* * * * * * * * * *

266 A. The patent teaches that the combination of the liquid low molecular weight plasticizer, of which in the specific examples of the patent dioctyl phthalate is indicated, that the combination of that liquid plasticizer, with the high molecular weight resinous plasticizer such as Paraplex G-25, yields the product of the invention, but it also teaches that polymerized ethyl acrylate is a suitable plasticizer to achieve the same result.
267 The Court:

Q. What does it take the place of if you use it? A. It takes the place of the combination of the blend of the low molecular weight DOP and the high molecular weight resinous Paraplex G-25. That is, the ethyl acrylate polymer resin itself provides the equivalent because it has low molecular weight liquid plasticizer in it along with the high molecular weight resinous plasticizer of non-migrating character.

* * * * * * * * * *

Q. (By Mr. Holmes) Where does the patent say that it takes the place of both and may be used as the sole plasticizer? A. That patent doesn't say it in those specific words but in my testimony, and the patent itself in
268 column 5, line 21, says: "ethyl acrylate polymer has been found useful as previously noted. This modifier has somewhat less tendency to cause tack loss than does the Paraplex G-25, hence may be used in even greater amounts in many formulations", and beneath that, start-

ing with line 31: "It will be understood that where specific ratios of specific polymers, low molecular weight plasticizers and high molecular weight plasticizers are described in the examples, substitution of equivalent but somewhat different materials may require alteration of these ratios in order to obtain equivalent results all in conformity with well recognized principles." Now, looking at example No. 1, you will note that 200 parts of Paraplex G-25 is indicated there. Now, that is a high molecular weight plasticizer and it is described in one of the examples of the patent. Example No. 1 also indicates 100 parts of dioctyl phthalate. Now that is a low molecular weight plasticizer, a non-volatile liquid plasticizer, and the patent teaches that if you are to substitute a somewhat different material for those specific materials of the examples, it may be required to somewhat alter the ratios or the amounts to obtain equivalent results, and that is exactly what was done in the manufacture of Exhibit T-14, which is the roll of
269 plastic tape wherein the polyethyl acrylate plasticizer was used in the ratio of 100 parts to zero parts of any other plasticizer, because it had within itself, the requisite amount of low molecular weight liquid plasticizer combined with the requisite amount of high molecular weight non-migrating resinous plasticizer, and it achieved or it gave the equivalent results of the example 1 of the patent.

* * * * * * * * * *

. . . Now, if I could call your attention to column 4, starting at line 58 and proceeding down to line 67. I will
270 quote from the patent: "and in which the ratio of vinyl chloride to vinyl acetate was approximately 89:11. The commercially available 'Vinylite VYNS', sold by Carbide and Carbon Chemical Corp., is a suitable copolymer

corresponding to this description. Other equivalent materials include copolymers having other vinyl-chloride vinyl-acetate monomer ratios such as 95:5. Polyvinyl chloride itself is satisfactory in many formulations". Now, frequent reference is made to what the patent teaches as the meaning of the ratios comprehended, and the ratios there go from 89 parts to 11 parts, up to 95 parts to 5 parts, up to 100 parts to zero parts. Now, over in line 31 of column 5 it says: "It will be understood that where specific ratios of specific polymers". Now, ratios there teaches that what is comprehended in reference to specific polymers that are to be used in achieving the product of the Oace patent, that you can use 100 parts of the specific polymeric material, as long as it has the liquid low molecular weight plasticizer in it, combined with the high molecular weight non-migrating resinous type plasticizer. Ethyl acrylate polymer resin is an example of such. Paraplex G-25 and Paraplex G-40 are also examples.

• • • • • • • • • •

272 A. My interpretation in reading the complete specification or patent is that ethyl acrylate polymerized resin may be used as the sole plasticizer, yes.

Q. And that is the teaching of the patent. That's your position. Is that it? A. I state that the patent teaches that to me, yes.

• • • • • • • • • •

It says it can be substtuted for the G-25 and it can be used in greater amounts than the G-25 in many of the formulations. It certainly does not say that it cannot be used alone as the plasticizer, and in knowing what ethyl acrylate polymerized resin is and how it may be made to one in the art, he would recognize that the mention of the acrylate

polymerizer resin alone, and that additional mention that it can be used in greater amounts than the amount
273 of the Paraplex G-25, and then being told by the language of the patent that the amounts of the materials in this specific example should be altered in the light of the specific materials used in order to obtain equivalent results, he would know that the ethyl acrylate polymerized resin alone is a satisfactory plasticizer for the vinyl resins. He would recognize that the Oace patent is teaching in that — teaching him that.

• • • • • • • • • • •

277 Q. Did this home-made Paraplex G-25 have an oil film on it? A. No, sir. . . . .

• • • • • • • • • • •

291 . . . The plastic electrical insulating tape essentially the same as Example 1, with use of either G-25 or Paraplex G-40, has continued over eighty per cent of the volume of output of plastic electrical insulating tape made and sold by Minnesota Mining and Manufacturing Company within that period of 1945 through 1953. The remaining twenty per cent included tape wherein a polymeric plasticizer of a non-migrating type was used as the sole plasticizer, and that remaining twenty per cent portion also included some of the straight polyvinyl chloride polymer film that was plasticized with the sole polymeric plasticizer.

• • • • • • • • • • •

299 Q. Now, the resinous type of plasticizer as thus referred to is of relatively high molecular weight is it not? A. Yes.

Q. The G-25 as I remember it is 8000 or thereabouts. Is that correct? A. It has a number average molecular weight

of 8000 but I would like to point out and explain that the very term there, number average molecular weight, indicates that there are present in the Paraplex G-25, molecules and percentage portions of different molecular weights. In other words, it's got a number of the low molecular weight molecules present, as well as a considerable portion of the higher molecular weight molecules.

• • • • • • • • • • •

300 A. I think in my testimony I said the molecular weight of Paraplex G-25 ran all the way from 1000 to 50,000. That is of the weight average, molecular weight basis.

Q. That doesn't tell us how many molecules are of 1000 and how many are of 50,000? A. No it does not but it is specifically more important where any formulation that requires weight of material, is specified, so that you get within the formula the material on the weight basis.

Q. Now, G-40 I think is 6000 average molecular weight? A. Rohm & Haas indicates that it has a number average molecular weight of 6000, yes.

Q. Have you ascertained what the weight distribution of G-40 is? A. Yes sir I have.

Q. The range? A. Yes sir, I have.

Q. How is that range? A. That ranges from 1000 to 50,000, but the molecular weight distribution indi-
301 cates that there is present in it a far larger quantity of lower molecular weight material than is present in the Paraplex G-25.

• • • • • • • • • • •

A. You have some material in Paraplex G-25 that would be identical to DOP in its viscous character.

Q. I thought you said it didn't run below a thousand. Now, that would be a lot more viscous, three times practically in weight than the DOP, and it would be substantially more viscous would it not? A. There is not a direct co-relation between the molecular weight of different chemical compounds and the viscous nature of those same compounds.

302 Q. But it remains resinous does it not? A. Yes, the portions of Paraplex G-25, the molecules and the parts of it, would all probably qualify for the term resin.

Q. Now here is Exhibit T-25-A, which is tabbed the liquid fraction of G-25. Now, it's your evidence then that this is substantially the same in its liquid character as DOP. Is that so? This pours something slower than molasses. The DOP is as light as can be. A. I don't believe I characterized those two as identically the same. I said that both were liquids. I believe I stated that the liquid portion of Paraplex G-25 was somewhat more viscous in character than the DOP.

• • • • • • • • • •

303 Q. Now, as to T-24, what you would term the light fraction remains a resin, T-24-A, a non-migrating resin plasticizer, does it not? A. I believe you have two sections in your question, or two parts of it. My answer to the first part is that the low-molecular-weight portion, the liquid part, Exhibit T-24-A, is properly termed a resin. I have forgotten now the second part.

Q. And it is a non-migrator; is that not so; it would be so classed? A. It is non-migrating when it is combined with its complementary portion, namely, the higher-molecular-weight, as that viscous alkyd resin portion of the Paraplex G-40, which is exemplified by Exhibit T-24.

Q. Is it not substantially non-migrating by itself? A. It is non-migrating under what conditions and with what, sir?

Q. Well, any vinyl chloride? A. Under what conditions, sir?

304 Q. Normal conditions, in a tape. A. In the pressure-sensitive adhesive tapes such as we are talking about here?

Q. Yes. A. I believe it would be non-migrating. Certainly it would not migrate as much as the dioctyl phthalate.

• • • • • • • • • •

306 Q. Now when did you make the polymerized ethyl acrylate which you said was fractionated by Dr. Rathman? A. Your question had reference to the tape?

Q. No, the polymerized ethyl acrylate which is Exhibit T-18? A. That material was produced sometime within the last 40 or 50 days.

Q. And produced at your plant of the Minnesota Mining? A. Yes.

Q. T-24 as I remember is the more viscous fraction of the G-40 which you fractionated. What is the molecular weight of the material T-24? A. The average weight, average molecular weight is approximately 15,000. Now, that in polymerizations of the type of linear polyester such as Paraplex G-40 represents, is approximately twice the number average of molecular weight figure, so that if that average molecular weight were to be expressed as the number average molecular weight, the Exhibit T-24 would have the number average molecular weight approximately in the range of 7000 or 7500.

Q. Now, take T-24-A which is the less viscous fraction

of the G-40, which was T-20, what is the molecular weight of that fraction? A. The weight average molecular weight of the material of Exhibit T-24-A is 5300, so that
307 the approximate number average molecular weight on that basis would also be approximately half, in the range of 2500, indicating that the liquid material there has from 1 to 20 links of the original unit, whereas the T-24 has material that runs all the way up to 150 links.

Q. You have said that the liquid material has so and so. Would it be accurate also to say that the resinous material has so and so, of T-24-A? A. Yes.

* * * * * * * * * *

A. The material of T-25, which is the more viscous resinous portion of higher molecular weigh of Paraplex G-25, has a weight average molecular weight of approximately 25,000, which indicated that the number of links of the original units present in that material, run from an aver-
age of 80 up to 150 or more, to yield that viscous
308 alkyd resin.

Q. Now, T-25-A was the less viscous alkyd resin portion of the G-25. What is the molecular weight of that less viscous alkyd resin portion? A. The weight average molecular weight of Exhibit T-25-A is approximately 10,000, which means that in that liquid material there are from 1 to approximately 36 links of the original unit.

Q. Now when Dr. Rathman fractionated the samples, what method did he pursue? Would you state it in reasonably simple terms so I can understand it and it will have to be simple? A. I'll do my best, sir. He dissolved the material in a ketone solvent and then progressively added water in small quantities to the solution. The higher molecular weight portion of the material tends to separate

out first. In other words, it is less soluble in the solvent, that might consist of 95 parts of the ketone solvent and 5 parts of water. Then that portion which is separated out was dried and evaporated, that is, the solvent was evaporated to leave the solid material. An additional amount of water was then added and the next range of high molecular weight material separated out, and so on until he got down to the remaining portion where the more
309 soluble lower molecular weight lighter part of the Paraplex G-25, Paraplex G-40 or ethyl acrylate, remained.

Q. So these heavier materials as you progressed, come off and then more come off and more and so on as you progress? A. The way they are separated, it is in just the reverse order of what you just stated. The higher molecular weight material comes out and then as you go along progressively the material of lower molecular weight tends to separate out until finally you are left with the material of the low molecular weight, which formed the liquid fraction.

Q. Well, it goes along progressively; so to speak; some heavy material comes off, and then some more, and then some more, and so on? A. Yes.

Q. So, in fractionating, you can divide the material into any sized fractions you desire, can you not? A. Yes.

Q. You can get a fraction of fifty per cent, the heavier material, and then take that and what is left is fifty per cent of lighter material? A. Yes.

316 Q. If you speak of an ester plasticizer, that term includes both liquid type plasticizer and resin type plasticizer, does it not? A. Yes, it might, under certain conditions.

Q. What conditions? A. The condition such as is present in Paraplex G-40, for example.

Q. Perhaps you will pursue that. I don't quite understand what you mean. A. The Paraplex G-40 has a portion of liquid ester plasticizer in it of low molecular weight, and it has in it a portion of soft, viscous alkyd resin of higher molecular weight.

Q. Is T-24, which is the heavier, more viscous fraction of G-40, an ester plasticizer? A. It is chemically a polymeric ester plasticizer that is non-migrating in character.

Q. So it is an ester plasticizer, using that term in its broad classification as we have been using it so far, as having an ester chemical structure? A. It is what they call a linear polyester plasticizer, yes.

Q. And it could be termed an ester plasticizer? A. Yes.

* * * * * * * * * *

319 Q. So T-24, T-24-A, T-25, T-25-A are all polymeric esters. Is that not correct? A. They are all polymeric esters.

Q. I notice at page 179 of the record and continually thereafter you referred to T-24-A, and I think you also referred to some of these other resin fractions as "an ester plasticizer"? A. Yes, that is what it is.

Q. And you referred to the heavier portions of the fractions as the portions or fractions of these polymeric esters as viscous resin plasticizers. Now, why did you refer to T-24 as an ester plasticizer? T-24-A as an ester plasticizer and T-24 as a resin plasticizer? A. Because that is what they are.

Q. Well, with equal truth you could have called them both

a plasticizer, couldn't you? A. Yes, they are both a plasticizer.

Q. And with equal accuracy you could have called T-24 an ester plasticizer. Is that not so? A. T-24 is an ester plasticizer of very viscous character because it is polymeric.

Q. Now, by calling T-24-A an ester plasticizer, you did not distinguish it in any way from DOP which is also an ester plasticizer. Is that not so? A. Both are liquid
320 ester plasticizers, yes, DOP and the material of Exhibit T-24-A, and they are both of low molecular weight as contrasted to the material of Exhibit T-24.

Q. Well, most of your answer was quite unresponsive. I asked you if DOP is not also an ester plasticizer? A. Yes sir it is.

Q. And when you call T-24-A an ester plasticizer, you do not distinguish it in any way from DOP? A. That's right, they are both properly called ester plasticizers, and they are both liquid and both of low molecular weight as contrasted to the material of Exhibit T-24, which is the soft, viscous resinous portion of higher molecular weight Paraplex G-40.

Q. By calling T-24-A a resin plasticizer, you do distinguish it from a liquid type DOP do you not? A. DOP is generally not called a resin.

Q. Is it ever called a resin? A. No it is not, not that I have ever come across.

Q. So if you want to distinguish T-24-A from DOP, you do, and you have in this testimony, called T-24-A a resin plasticizer? A. It is a liquid ester plasticizer.

323 Q. Now, when you mix G-40 or G-25 let us say, with DOP, take a ratio of two to one, you have a mix-

ture of a very low weight migrating liquid type plasticizer and a high molecular weight non-migrating viscous resin type of plasticizer. Is that not so? A. You have a plasticizer blend.

Q. Well, it can be termed a mix can it not? A. If you prefer to call it a mixture, I imagine that is your preference.

Q. And each of those constituents, DOP and the G-40 let us say, maintains its identity. There is no chemical change? A. In a blend or mixture as you prefer to call it of DOP and Paraplex G-25, you have a physical mixture in which the DOP and the Paraplex G-25 are not chemically combined; that is, the DOP can be separated from the blend of the two materials.

* * * * * * * * * *

330 Q. Now, are all these which I have enumerated, except G-20, and which are non-polymeric, migratory and capable of producing pastiness of adhesive when used as a sole plasticizer with vinyl chlorides in amounts sufficient to give adequate strength, say over 20 parts up to 30 or 35, or whatever? A. I don't know sir. I haven't tried them. They are all examples of liquid ester plasticizers, namely, esters of similar type di-carboxylic acids and they were referred to for that purpose of showing that in the literature the esters of phthalic acid, adipic acid and sebacic acid, are commonly grouped together as similar materials for similar plasticizing end use.

* * * * * * * * * *

Cross Examination

By Mr. H. L. Kirkpatrick:

332 Q. Did I understand you to say this morning, Mr. Tierney, with regard to T-34-A, that it had molecules of from one to twenty units or links? A. Yes.

Q. And that T-25-A has molecules of from one to thirty-six units or links? A. Yes, sir.

Q. Do you agree that you previously testified that
333 the lowest molecular weight in G-40 was a thousand?

A. I may have said that, yes.

Q. Then will you also agree that the unit of G-40 is about 174, or thereabouts? A. No, I will not agree to that. The individual unit of G-40, which constitutes the combination of adipic acid with two molecules of propylene glycol and the resulting elimination of two molecules of water, yields a unit that is 262, which is the molecular weight of the one unit of G-40 that may combine together with other units in making the polymer of increasing molecular weight in the polymeric material.

Q. But, at any rate, is not the chain a multiple of units of the order of four or five, even on your figure of 262 instead of my figure of 174? A. The majority of the material is above 262; in other words, there is not much of the one-unit material in the Paraplex G-40. However, there is the appreciable quantity of the liquid material that comprises varying amounts, running from two, three, four, five, ten, or twenty links, which, when combined together, yield the liquid material of the Exhibit T-24-A.

334 . . . and, as a practical matter, don't chemists like you divide that unit, which you took at 262, into the thousands to get the minimum number of units? A. I don't know that I understand your meaning there.

Q. Your unit value was 262? A. Yes, that is the original unit of the reaction between adipic acid and two molecules of propylene glycol to form the di-glycol, di-propylene glycol adipate.

Q. And dividing the 262 into a thousand we get approximately four? A. Yes.

Q. And wouldn't that indicate, then, that the minimum length of chain was four or more, to a chemist? A. It would. If I said that the Paraplex G-25 and the Paraplex G-40 was one to fifty thousand, I was giving the approximate range by molecular weight that is present. I will say that there may very well have been a small portion that would be from five hundred to fifty thousand.

Q. But you don't suggest that there was a portion of monomer in there? A. There might be a very small portion of the original single unit present; it would be very small.

Q. And you really mean very small? A. Yes.

335 Q. Such as would normally go out in a finishing operation of the material? A. I would say that it is present to the extent of less than one per cent.

Q. It might even be infinitesimal; more likely infinitesimal? A. That would depend on the way it was made. The range of molecular weights that the person obtains in linear polyester condensations of that type, such as produces Paraplex G-25 and such as produces Paraplex G-40, depends upon the conditions under which it is made and, particularly, the amount of vacuum and the time interval that it is heated or reacted and upon how it is agitated in the procedure.

Q. Is there any evidence of any monomer in the G-40 that you have ever seen or heard of? A. I, personally, have not found any, but I, personally, have not fractionated the G-40 or the G-25 with the express aim of attempting to determine whether there is any monomeric unit present of the reaction product of adipic acid and propylene glycol.

Q. Now, passing to T-25-A, did you say that it has units from one to thirty-six or more? A. That was Exhibit T-25-A?

• • • • • • • • • • •

338 A. . . . .I will say that there is enough liquid ester material in the Paraplex G-25 of current manufacture, and also an absence of real high molecular weight material in today's Paraplex G-25, such as to make Paraplex G-25, as it now exists, satisfactory for producing a saleable stretchable and retractable, plastic film backed, electrical pressure-sensitive adhesive tape, as described in the Oace patent.

Q. Is there any evidence that the current G-25 is any different from the 1944-1945 vintage of G-25 in that respect?

A. Yes. There is the evidence that I referred to in my testimony; namely, that, using today's Paraplex G-25, a pressure-sensitive adhesive tape of the type of the Oace patent is obtained, whereas, when Paraplex G-25 of the 1944-1945 vintage was utilized, that was not obtained, and the patent states that it was not obtained at that time.

Q. But you have given oil as one reason, as the difference between the two? A. Yes, I have referred in my testimony to the fact that the Paraplex G-25, as we received it from Resinous Products and Chemical Corpora-
339 tion, who at that time were a subsidiary of Rohm & Haas Company, had a layer of liquid oil on the surface of the Paraplex G-25 of that date; and some of the exhibits, namely, the analytical report of Mr. Perlich, confirmed the fact that there was oil present in the Paraplex G-25 of that date, and enough oil to be discernible in the analysis of the material. Just a moment and I will try to find the exhibit number of the Perlich report.

Q. I think it was 16, wasn't it? A. It was Exhibits 15 and 15-A.

Q. Is it your position that the old G-25 had more than a fraction of one per cent of the monomer present? A. No.

Q. But is it your opinion that in the current G-25 and G-40, that in each case there is a separable amount of the monomer?

* * * * * * * * * *

A. I have stated that I, personally, did not attempt to find any, nor did I direct Dr. George Rathman to attempt to find out how much of the monomer unit was present in today's Paraplex G-25 and today's Paraplex G-40.

340 Q. Then you have no opinion on the matter? A. I have an opinion on the matter, yes, from my knowledge of what would be the result in reacting the materials, namely, sebacic acid and di-propylene glycol—excuse me, in reacting sebacic acid and propylene glycol, and is reacting adipic acid and propylene glycol, and that opinion is that there could be some amounts of the single-unit material present. There would not be much and the amount that would be present would depend on the method of manufacture used. If the method of manufacture was such that not a good vacuum was maintained on the resin reaction kettle, and if the material were heated for a long period of time, the amount of the single-unit or monomer material would be more, because that reaction is a reversible reaction.

Q. Well, your position is that there could be some very small amount present in each case, a fraction of one per cent? A. Yes; and I will say that in 1944 and '45 there might very well have been three or four per cent of single-unit material present in the Paraplex G-25 of that date, because it would depend, as I stated, on the type of equip-

ment they had at that time, the quality of the vacuum, and the length of time that the materials were heated in
341 the reaction, and it would also have some bearing as to the size of the batch and the quality or efficiency of the agitation of the ingregients, namely, the sebacic acid and the propylene glycol.

• • • • • • • • • • •

No Redirect Examination

• • • • • • • • • • •

Plaintiff's witness **Ross I. Parker**

Direct Examination

By Mr. Harold J. Kinney:

• • • • • • • • • • •

342 Q. How long had you been employed by the General Electric Company prior to that time? A. Forty-three years and three months.

• • • • • • • • • • •

343 Q. What was your position with the General Electric Company just prior to the time of your retirement? A. As Commercial Vice-President, in Chicago.

Q. And how long had you occupied that position? A. Since July of 1948.

• • • • • • • • • • •

A. I entered the company's employ immediately or within a few weeks of graduation from the University of Kansas, where I had obtained a degree of Bachelor of Science in Electrical Engineering, put on overalls and worked fifty-five hours a week for twenty cents an hour.

• • • • • • • • • • •

344 Q. Did your company at one time introduce a product, insulated conductor or wire, known as FLAMENOL? A. Yes, sir.

Q. Can you tell us about when that was? A. To make sure that I remember the date, that trade-mark was registered in January of 1937.

• • • • • • • • • • •

345 Q. Now can you tell us in a general way how the FLAMENOL conductors or wires differed from what had preceded that? A. Well, the normal insulation used on electrical conductors prior to the availability of FLAMENOL consisted of rubber in various stages of purity, depending upon the application of the cable and the temperature to which it was subject, which was one of the limiting features. FLAMENOL, it was found that this material could stand substantially higher temperatures, and that was one of the real outstanding contributions made by that type of installation.

• • • • • • • • • • •

346 Q. How was this FLAMENOL wire spliced when electrical connections were made with it, back in the early days? A. The normal procedure would be to strip the insulation, twist the power conductors together, solder them; then use a rubber tape over that joint and a friction tape, as it was called, over the rubber tape.

Q. What can you say as to how satisfactory that type of splice was? A. Well, it had this handicap, in that it was subject to the same limitations as to temperature that the earlier rubber insulation had. Rubber will sustain combustion and is made, I believe you chemists would say, plastic by heat, will flow if it gets hot enough. So
347 will FLAMENOL, for that matter, but FLAMENOL will not sustain combustion and is subject, as I re-

call it — the underwriters gave eighty degrees, I think it was, for FLAMENOL and about sixty for rubber.

• • • • • • • • • • •

Q. So do I understand that when you spliced a joint on the FLAMENOL wire with the rubber electrician's tape and friction tape, then you had, so to speak, a weak link in the electrical conductor? A. That is correct.

• • • • • • • • • • •

Q. Did you at some time become familiar with a convenient, effective insulation material for splices on your FLAMENOL wire? A. Yes.

348 Q. What was that? A. That was this number 33 SCOTCH tape.

• • • • • • • • • • •

Q. Now can you tell us about when you first became familiar with that, or when your company first started using it or selling it? A. Well, in Chicago I know that we started purchasing it in early 1947. It was sold there through the General Electric Supply Corporation, a wholly-owned affiliate or subsidiary.

• • • • • • • • • • •

350 Q. Now I show you a document which has been marked for identification as H-13-B which bears the date of August 25, 1947, and is on the letterhead of General Electric Supply Corporation, and ask you if you can identify that or the signature on it? A. Yes, the signature is A. J. Lutz who at that time was Manager of the Supply Sales Division of the General Electric Supply Corporation's operation in Chicago.

Q. And this document refers to No. 33 Scotch electrical tape does it not? A. Yes.

Q. Do you note the first sentence there, which I will read: "For the first time in fifty years a revolutionary electrical tape is on the market ready for immediate delivery". A. Yes sir.

Mr. Holmes: What's the date of that? A. August 25, 1947.

The Court: Whose statement was it that you were reading about being a revolutionary tape? A. That was Mr. Lutz's statement.

351 Q. Did the advent of this Scotch plastic tape such as that No. 33 we spoke of, have any particular significance in connection with the use of General Electric Company's Flamenol wire cables? A. Yes, it was an aid to us in selling more of the product because of the elimination of the weak link, as you mentioned a while ago.

Q. Would your company have had a use for the No. 33 plastic tape of Minnesota Mining if it had been available on the market when your company first started merchandising Flamenol wire back in 1936? A. Yes.

Q. What effect, if any, did the advent of the plastic tape have on the applications and use of your Flamenol insulated wire and cable, after it came on the market? A. Well, as I thought I said, it made a complete job. It made it simple to use when a joint was necessary, as it frequently is.

Q. Did it widen the application and use of your Flamenol wire? A. Exactly. Anything that makes it easier to sell goods, that falls in that classification.

Q. Would there have been a market for this No. 33 vinyl plastic tape if it had been available on the

352 market around the time when you started with the General Electric Company in 1912? A. Yes, because — well, just one example of it is, no longer did a chap in overalls have to carry two rolls of tape in his pocket. He could do the same job with one roll.

• • • • • • • • • • •

No Cross Examination

• • • • • • • • • • •

Plaintiff's witness **Charles A. Womack**

Direct Examination

By Mr. Welch Jordan:

• • • • • • • • • • •

352 Q. What sort of business are you in? A. Wholesale electrical and electronics supply business.

Q. How long have you been engaged in that business? A. Approximately seventeen years.

353 Q. How many places of business do you operate?

A. We operate a total of three electrical and five electronic supply houses.

Q. Where are they? A. These are located in High Point, Danville, Durham, Goldsboro. We have two stores in Goldsboro and Rocky Mount and in Lynchburg, Virginia.

• • • • • • • • • • •

Q. Are you familiar with Scotch brand No. 33 tape which has been identified and offered in evidence in this case as Exhibit T-4-a? A. Yes sir I am familiar with it.

Q. When was the first time that you saw that type of tape approximately? A. Well, the best I can recall, ap-

proximately 1947 or 1948 we noticed advertisements in trade journals. As this tape seemed to be quite different from anything I had ever seen before, we immediately contacted the Minnesota Mining to see if distribution would be available to us.

Q. Now, prior to that had you even seen any tape like that before? A. No sir.

* * * * * * * * * *

354 Q. What sort of tapes do you refer to when you say two had been used previously? A. Normally in electric insulation the wires and cables are wrapped with a rubber compound tape over which is put a cloth asphalt coated tape as a protection.

Q. Is that cloth asphalt tape what is known as friction tape? A. That's the common name for it, yes sir.

* * * * * * * * * *

355 Q. Now Mr. Womack, you testified that you started in this business of wholesale electrical sales seventeen years ago. At the time you started in this business, if this Scotch No. 33 tape had been available at that time, would there have been a market for it? A. Yes sir, there would have been.

* * * * * * * * * *

No Cross Examination

* * * * * * * * * *

Plaintiff's witness **George S. Miles, Jr.**

Direct Examination

By Mr. Welch Jordan:

Q. Mr. Miles, where do you live at the present time? A. 1347 Citadel Drive N. E., Atlanta, Georgia.

Q. How long have you lived in Atlanta? A. I have lived in Atlanta since February of '53.

Q. Where did you live before you moved there? A. Greensboro, North Carolina.

Q. How long did you live in Greensboro? A. Since 1927.

356 Q. You were raised and educated here were you? A. Yes I was.

Q. By whom are you employed now? A. Minnesota Mining and Manufacturing Company:

Q. How long have you been employed by Minnesota? A. Since March of 1947.

* * * * * * * * * * *

357 Q. They were both pressure-sensitive electrical insulating tape? A. Black insulating tapes, yes.

Q. Now, what position do you occupy with the company at the present time? A. Sales Manager.

Q. For what area? A. For the Southeastern area.

* * * * * * * * * * *

360 Q. Roughly how many dollars worth of tape did you sell in the Carolinas and adjacent Virginia area in 1947, '48 and '49, that is, of this plastic electrical tape No. 33 and 22? A. The records show that for the years '47, '48 and '49 there was $88,105.00.

361 The Court: Q. In the three years combined? A. Yes sir.

Q. Give me the amount again? A. $88,105.00.

Mr. Jordan: Q. Who sold that $$88,105.00 worth of tape? A. I'd like to think that I was personally responsible for the sale of that tape.

* * * * * * * * * * *

A. The first similar competitive tape I saw in Greenville, South Carolina.

Q. When? A. That was in 1950.

* * * * * * * * * * *

365 The Court: Q. What proportion do the tape sales bear to the other products that you sell? I don't mean exactly but approximately? A. I would say that the tape sales approximately represent 90% of the other products that I sell, dollarwise.

Q. Ninety percent dollarwise? A. Yes sir.

* * * * * * * * * * *

Plaintiff's witness **R. V. Holton**

Direct Examination

By Mr. E. E. Ezell:

* * * * * * * * * * *

366 Q. By whom are you presently employed and what is your present position? A. By the Minnesota Mining and Manufacturing Company and I am the General Manager of the Electrical Products Division.

367 Q. From what college or university, if any, did you graduate and in what year? A. From the University of Minnesota in the year 1938.

* * * * * * * * * * *

368 Q. When was the first sale and to whom was the tape sold? A. The first sale was in February of 1945 to the Lyon Manufacturing Company in Chicago.

Q. This sale was made by you? A. Yes it was.

Q. That was the first sale that was consummated? A. Yes it was.

Q. Was this a new item in your experience? A. Yes it certainly was.

• • • • • • • • • • •

373 The Court: Is Exhibit H-3-A the same type of pipe or conduit? The Witness: Right.

The Court: But wrapped with this tape? The Witness: Yes, it is.

The Court: But it does not appear to have been injured, although it has been in use eighteen months? The Witness: A year and a half.

The Court: That piece of pipe, if not wrapped with the tape, would have been exposed to the same conditions? The Witness: As far as we know, the vapors would attack both pipes in that area.

• • • • • • • • • • •

382 Q. Now, dollar-wise, how much of the vinyl plastic electrical tape, pressure-sensitive electrical tape, did your company sell in 1945? A. In the neighborhood of ten thousand dollars.

• • • • • • • • • • •

The Court: How have you got that sheet marked? The Witness: That is Exhibit H-12.

The Court: Is it a correct statement of the sales annually? The Witness: It is taken from the company
383 records, showing both sales and advertising expense.

• • • • • • • • • • •

The Court: Why did you not give us the figures for 1954 and 1955? I see that tabulation stops at 1953.

Mr. Ezell: Your Honor, I think I can answer that. The suit was filed in 1954. We brought the records up to 1953, and that is as far as we haven taken them.

Q. Has SCOTCH vinyl plastic electrical pressure-sensitive tape received the approval of the Underwriters' Laboratory? A. It has.

Q. When? A. In the year 1947 first.

* * * * * * * * * *

Plaintiff Rests

* * * * * * * * * *

Defendants' witness **John M. De Bell**

Direct Examination

By Mr. Hector M. Holmes:

* * * * * * * * * *

422 A. The very first vinyl chlorides with which we worked around 1928 were used in a small way for molding compounds. Later they became used for sound records. A very large use which developed in the middle thirties was for rain-wear, shower curtains and cable insulation. These uses were of immense importance at the beginning of the war when the entire supply of polyvinyl chloride went to Army raincoats and to Navy flame-proof cable. The Quartermaster used both supported film for rain-wear and unsupported film for envelopes for weapons which were to be used in landing operations. Since that time the polyvinyl chloride has gotten into tremendous uses in drapes, curtains, upholstery, flooring, and
423 all types of utilitarian articles.

* * * * * * * * * *

425. Q. And were vinyl compounds available in the thirties, as ordinary articles of commerce, having the high vinyl chloride content? A. Yes. Now, they were

available from many people and were principally used in the rubbery, stretchable form.

Q. Was the VYNS such a product? A. Yes it was. That is, the base resin.

Q. And was the VYNW another such product? A. Yes it was. Those were both made by Union Carbide, now Bakelite Division.

Q. And both were staple articles of commerce in the thirties? A. Yes.

• • • • • • • • • • •

427 . . . I'm sure that most of you recall the early shower curtains which were very flexible and rubbery at first, but had a tendency to stiffen on aging, as there was slight evaporation of the plasticizer.

• • • • • • • • • • •

429 Q. Were some of the liquid plasticizers more migratory than others? A. Yes, but that is difficult to define, because migration depends not only on the small size of the molecule but also on how good a solvent it is for the polymer from which it is leaving and how good a solvent it is for the polymer or material to which
430 it is going.

• • • • • • • • • • •

477 Q. What makes one plasticizer migrate and another type not migrate? A. There are several factors, one of which is the solubility of the plasticizer in the various things it is migrating to and from, but probably the greatest influence is just the size of the molecule itself. The little molecules, or those in the low molecular weight liquid plasticizers, those molecules are little fellows which can get around quite readily.

• • • • • • • • • • •

482 A. Well, ester plasticizers are normally applied to the liquid plasticizers, but it is chemically correct to apply "ester" to any chemical structures, including resins, which have ester structures in them.

• • • • • • • • • • •

483 The Court: Wait one minute please. I want you to take pages 179 and 180 of the record. I'll give you my copy, and point out what it is you say is grossly in error, or misleading.

A. Here on page 179, the fifth line from the top, Mr. Kingsland remarks about a bottle, 24-A, a plasticizer, and then he says: "Is it an ester plasticizer". The answer is: "Yes it is." He says: "Is it a liquid ester plasticizer." The answer is: "Yes, it is." Now, it is quite true that all these resin plasticizers are liquids in the sense that they are not gasses, they are not solids and they can in time—they can slowly be poured, but in the Oace patent, Oace makes a clear distinction in column 3, line 27, between a low—line 26—a low molecular weight liquid plasticizer and in line 29: "A high molecular weight resin type plasticizer." This fraction marked 24-A is a high molecular weight resin type plasticizer, and the answer to this question makes it appear that it might be a low molecular weight liquid plasticizer, which it definitely is not.

484 Q. He didn't say it was a low weight liquid plasticizer. Now will you read the balance of what he says on page 179 and page 180, in explanation of that? The reason I'm asking you these questions, you say he was grossly in error, and I want to know in what particular.

A. I understand sir.

Mr. Holmes: I think he used the word "misleading", your Honor.

A. It is certainly confusing here because Oace has defined, and we talked yesterday, and the trade understands the two plasticizer system, one liquid, which is the monomeric type, one resinous which is the high molecular weight resin type.

The Court:

Q. Now if I understand what the witness said on page 179 and page 180, he says that by the use of this you can get the same result here. I'm not talking about the Oace patent. I'm talking about what he testified and what you say is grossly in error, so that puts your testimony in flat contradiction to his and I want you to be specific about it because it is rather important. A. I understand sir. In looking at page 180, the remark is made that when 24-A—when the liquid material of Exhibit 24-A is mixed with a soft viscous resinous portion of Exhibit T-24, a non-migrating plasticizer blend is produced which, when
485 used in the same manner as the procedure indicated in the example in one of the Oace patents, it produces the same end results, etc.

Q. Do you say that is erroneous? A. This says that if the G-40 is reconstituted from the two fractions, it will make a good tape. We know from other experience—in fact from my own experience—that G-40 alone, and G-25 alone, will make a good tape. That is known now, but Oace teaches very clearly first, that you must have in addition to the resin plasticizer, a liquid—a low molecular weight liquid plasticizer such as dioctyl phthalate, and he specifically warns against taking a mixture like this and making a tape, although it is well known to us now that it will make

a good tape. That is the precise thing which Oace in column 3 line 45, says specifically cannot be done, and he says it again . . .

Q. Aren't you in this regard saying that this testimony has demonstrated that you can get a result contrary to the teaching of the Oace patent? A. Yes, of course.

Q. But are you saying now that you can't get what this witness said you could get? A. You'll get a very good tape this way.

Q. That part I understand wasn't in error. A. It wasn't
486 in error but the error arises in characterizing and confusing the lower molecular weight resin fraction, which is just another resin plasticizer, with the liquid plasticizer specified by Oace.

• • • • • • • • • • •

487 The Court: Excuse me for interrupting there, but on page 177 the same witness, speaking of Exhibits T-24 and T-24-A, representing the fractional parts of the original Paraplex G-40, as shown by Exhibit T-20, said: "In other words, in this bottle, namely, Exhibit T-24, we have 67 percent, which is the more viscous, higher-molecular-weight resinous portion of the Paraplex G-40 as represented by Exhibit T-20."

Mr. Holmes: Yes.

The Court: Now he says: "Exhibit T-24-A represents 33 per cent of the original Paraplex G-40, which is the more liquid, lower-molecular-weight part of the original Paraplex G-40."

Do you agree with that, or is it grossly in error?

The Witness: It is true that of the more —

The Court: No. I asked you if you agree that that is correct, or do you disagree with it, as being erroneous too.

The Witness: I think the statement is correct, but it tends to confuse the two resin fractions with the liquid plasticizer.

The Court: Then he goes on further to say: "If I add these two bottles together and homogeneously mix them, that is, the Exhibit T-24 and the Exhibit T-24-A, I get six ounces, exactly the same thing that I have in Exhibit T-20."

488 **The Witness:** That's correct, sir.

The Court: I want to know if you agree with that.

The Witness: That is reconstituting the original resin plasticizer.

The Court: Well, if that's true, the division of it is manifestly true also, isn't it?

The Witness: It is quite true that those two fractions are also resin plasticizers and part of the original resin plasticizer. In fact, you can see, sir, by looking at the bottles —

The Court: I wasn't asking about that. I was trying to see how far it's possible for you two to agree on something. He says, on page 177, that in T-24 "we have 67 per cent, which is the more viscous, higher-molecular-weight resinous portion;" and then the "T-24-A represents 33 per cent of the original Paraplex G-40, which is the more liquid, lower-molecular-weight part of the original Paraplex G-40."

The Witness: Well, while that is technically correct, it would be more proper to say the lower molecular weight

resinous portion. I think that confusion will be made clear, sir, if one remembers that once a resinous plasticizer, always a resinous plasticizer.

The Court: I see what you are talking about.

• • • • • • • • • • •

499 Mr. Holmes: Q. Referring to this ethyl acrylate which he produced, he (Tierney) states: "The composition that it has is controllable by the organic chemist, the polymerization chemist; he tailors it to produce
500 the ethyl acrylate polymer resin of the properties that he wants for the purposes involved". A. That is a correct statement, and the tailoring means that by varying the conditions of the polymerization, for example, the concentrations, the method of polymerization, the time, the temperature, the catalyst and other factors, different types of polymer can be produced as desired.

Q. Can the monomers be retained by such a tailoring, with ethyl acrylate? A. If the polymerization is not carried to completion, and if the product is not stripped, there will be monomer in the product.

• • • • • • • • • • •

503 The Court:

Q. Let me ask you a question. On page 106 of the record Mr. Tierney said: "That film backing was 100 parts of the VYNS resin, 50 parts of ethyl acrylate polymer resin, 3.6 parts of calcium stearate. Now it was blended and milled, etc." Did your test of that sample disprove the use of the component parts outlined by the witness? A. Not at all sir.

Q. Did it agree with it? A. I have no reason to question that statement.

Mr. Holmes:

Q. Is there any reference in those patents to anything comparable to this tailored ethyl acrylate? A. Well, as regards the use of the ethyl acrylate, in this tape, I find no reference in the Oace patent to any tape that is made with a substantial portion of volatile solvent as an ingredient.

The Court:

Q. Let me ask you this: He says this thing we are talking about was blended and milled according to
504 the method described in the patent in example 1, column 6. Does that assist you in any way in answering the question Mr. Holmes just asked you? Described in example No. 2 of the Oace patent? Wait a minute. Let me make my question a little more clear so we won't be confused. The witness said that it was blended and milled according to the method described in the patent in Example 1, column 6. It was made to a 4 mil thickness. The backing was primed with a primer described in example No. 2, and it was coated with pressure-sensitive adhesive described in No. 2 of the Oace patent. A. The point I'm trying to make sir, is that the tape here had a substantial amount of volatile solvent which is not covered anywhere that I am aware, in the Oace patent. The Oace patent always specifies regarding the plasticizer system, that it is a two component system of low molecular weight liquid plasticizer and high molecular weight resin type plasticizer. It appears that there is ethyl acrylate monomer in this sample which does not come under either of those descriptions. It is a volatile solvent and it will disappear.

• • • • • • • • • •

Cross Examination

By Mr. Harold J. Kinney:

• • • • • • • • • •

522 **Q. . . . You read the Oace reissue and original patents, I assume? A. Yes.**

Q. Did you study the file history of each? A. No.

Q. Did you read them at all? A. Yes.

Q. You read them, but you did not study them? A. That's correct.

Q. Did you scan through each one? A. Yes.

• • • • • • • • • •

523 **Q. Have you ever been at the plant of Plymouth Rubber Company? A. No.**

Q. You have never seen them make any of this tape? A. No.

524 **Q. Have you ever seen pressure-sensitive tape made in a commercial plant? A. No.**

Q. Neither of this vinyl plastic tape or any other kind of pressure-sensitive tape; is that right? A. No—that's correct, yes.

• • • • • • • • • •

525 **Q. Did you make any study with reference to the poisoning of pressure-sensitive adhesives prior to your testimony here? A. Yes.**

Q. Since this litigation commenced? A. Since this litigation commenced.

Q. None before that? A. None before that.

• • • • • • • • • •

Q. Have you made studies of migrations of various plasticizers? A. I don't know whether you would call them studies. I have been faced with that as a technical problem since 1936 and '37. We had difficulties to overcome which involved migration of plasticizers.

Q. And since you have been concerned with this case have you learned that the migration of plasticizers is a particularly acute problem in connection with making a stretchable, retractable plastic tape? A. I am not aware that I have learned anything since the commence-
526 ment of this case that I did not know, at least qualitatively, before regarding migration.

Q. Have you ever made any studies about the spewing, or syneresis, effect that is sometimes encountered in plasticizing polymers or copolymers? A. Again I don't know whether you would call them studies, but I have been faced with it as a problem, many times.

• • • • • • • • • • •

529 Q. Now would you say that Paraplex G-25 of 1945 vintage, blended with a vinyl, may have been an improper combination? A. I would expect it to be a proper formulation.

Q. Did you ever blend any Paraplex G-25 with a vinyl film in 1945? A. No.

• • • • • • • • • • •

Q. Did you notice more variation in the G-25 from batch to batch in 1945 than you have noticed recently? A. We had only one batch, 5409.

Q. Rohm & Haas had many, many batches? A. Yes.

Q. And didn't you get more than one sample from them in 1945? A. We have only 5409, it is the only sample I

know of that we have from Rohm & Haas in that
530 period.

Q. Did you, yourself, have that in 1945? A. Yes.

Q. And you have had it ever since? A. Yes.

Q. Well, is that the only sample you got of it in 1945? A. Yes,

Q. So you don't know whether Rohm & Haas' commercial production varied from batch to batch? A. No.

Q. Now I understand that your first experience with avoiding poisoning of adhesives has been since you have been engaged in this case, in the last year or so? A. I wouldn't say that, although we have never referred to the poisoning of adhesives, as such. Over many years and in many different connections we have been faced with the problems of difficulties with adhesives which probably could be described as poisoning, in the sense that they either get stickier or get less sticky.

* * * * * * * * * *

531 Q. This experience you had with poisoning of adhesives prior to your engagement in the present case was a rather casual experience; is that right? A. No, it was dfinitely not casual. I can't say that it was particularly related to this case.

Q. Did it concern itself with pressure-sensitive adhesives? A. No.

Q. It did not?

* * * * * * * * * *

534 Q. I was looking at Claim One when I phrased this question, and I said, it appears to me that this patent suggests taking a plasticized polyvinyl chloride sheet, coat-

ing on one side of it a polymer of isobutylene and then coating thereover a pressure-sensitive adhesive, the theory being that a polymer of isobutylene will prevent the migration of plasticizers from the backing into the adhesive. Is that not an accurate characterization? A. That seems consistent with Claim One.

• • • • • • • • • • •

535 Q. You agree that I accurately characterized this invention? A. Yes. that seems quite consistent with Claim One.

Q. Now, at the time did that seem to you like a good suggestion of a way for preventing migration of the plasticizer from the backing to the adhesive? A. Yes.

Q. And was that suggestion made because neither you nor Mr. Nickerson at that time knew of any way of setting up an equilibrium between the adhesive and the plasticized backing so that the tape would not lose its tack or go pasty over a period of time? Is that the reason why the barrier layer was put in between? A. No. My recollection is that we were trying to get a better bond between the back-
536 ing tape and the adhesive. That is my best recollection at this late date.

Q. Well now, this Claim One says that this polymer of isobutylene prevents the migration of migratory plasticizers from the backing into the adhesive? A. That is correct.

Q. Wasn't that the purpose of putting that polymer of isobutylene on the plasticized vinyl backing? A. That was *a* purpose but not as I recall it, *the* purpose.

Q. Well, in addition do I understand you are saying that of course you would have to get good bonding between or

you wouldn't have a unitary tape? A. We wanted better bonding between, as I recall it.

Q. Better bonding than what? A. Better bonding between the adhesive layer and the polyvinyl chloride acrylonitrile rubber backing than we had obtained up to that time.

* * * * * * * * * * *

539 Q. This top surface is the pressure-sensitive adhesive. Now, when we wind this upon itself, the pressure-sensitive is going to come right over in contact with the vinyl film, or the plasticized vinyl film? A. Yes.

Q. Now, what's going to keep the plasticizer from migrating? A. Which plasticizer?

Q. The plasticizer of the vinyl film? A. The plasticizer of the vinyl film is non-migrating plasticizer.

540 Q. So there was no need for the barrier coat at all? A. No. The things that would migrate are in the adhesive film.

* * * * * * * * * * *

Q. So that we don't get too far afield, if you will look at the very end of Claim One you will see the language: "In preventing the migration of migratory plasticizers from the backing into the adhesive"? A. That is correct.

* * * * * * * * * * *

541 Q. Well now is there some mistake here where this Claim One was talking about preventing migration of the migratory plasticizers from the backing, into the adhesive? Is that not really a problem? A. That certainly was a problem at that time.

* * * * * * * * * * *

543. Q. If the adhesive is bonded strongly to the backing initially, are you saying that there isn't much tendency for it to offset even if the plasticizer migrates into the adhesive and renders it pasty? A. No. If there is any surface of the backing material which attacks the particular adhesive used, or vice-versa, there will be trouble unwinding.

* * * * * * * * * * *

544. Q. Didn't Dr. Nickerson contemplate winding it up in a roll? A. Yes.

* * * * * * * * * * *

545. Q. Well now let me ask you another question like the last one, but I want to confine it to pressure-sensitive tapes. Was your work in connection with this project with Dr. Nickerson, your introduction to the problem of preventing migration in connection with the making of pressure-sensitive adhesive tapes? A. I think so. I do not recall at the moment earlier instances.

* * * * * * * * * * *

546. Q. Well, you knew of the Scotch brand stretchable and retractable vinyl backed electrical tape before the Nickerson application was filed on November 20, 1948. Is that correct? A. I think so.

* * * * * * * * * * *

550. Q. Now, before we leave this subject, what was your first introduction to the problem of migration in connection with pressure-sensitive tapes; was that in connection with the Nickerson project? A. This is the first one that I recall at the moment.

* * * * * * * * * * *

551. Q. This is the sole project of your laboratory, which blossomed into an application, that you can recall? A. And a patent, yes.

Q. This Nickerson patent? A. That's right.

* * * * * * * * * *

552 Q. Did you make any pressure-sensitive stretchable and retractable vinyl plastic tape of any kind? A. No.

553 Q. None at all? A. No; that is, with all the adhesive and the priming layer and everything on.

* * * * * * * * * *

554 Q. I am referring to that language which says: "These unique and valuable results are obtained by utilizing an insulating tape in the form of a relatively thick but easily stretchable and highly elastic pressure-sensitive adhesive tape comprising a well-bonded, water-insoluble, non-corrosive, normally tacky and pressure-sensitive adhesive coating on a plasticized vinyl chloride
555 polymer film which is in permanent equilibrium with the adhesive," and then "permanent equilibrium" is defined. A. Yes.

Q. Now this patent solved that problem, didn't it? A. Yes.

Q. And that was the central problem in this patent, wasn't it? A. I would say so.

* * * * * * * * * *

556 Q. And various plasticizers migrate; G-40 migrates, doesn't it, unless you have a state of equilibrium? A. As a practical matter, G-40 doesn't migrate.

Q. Well, how about G-25; does it migrate? A. As a practical matter, G-25 doesn't migrate.

Q. What do you mean by "a practical matter"? A.
557 I earlier stated that I felt that even the non-migrating plasticizers migrate, but it would probably take

so long for them to become ineffective, for example, five hundred or a thousand years, that it would not concern us seriously.

Q. I believe you have said that you have looked at this Rohm & Haas literature, those booklets on plasticizers, and so forth; is that correct? A. I have looked at some, yes.

Q. And, in general, do you feel that those are quite authoritative works on the habits of plasticizers? A. Yes.

Q. How much plasticizer like G-40 or G-25 will migrate depends on what it is next to, doesn't it? A. Among other things, yes.

* * * * * * * * * *

559 Q. Then am I not right in saying that this table illustrates that, in contact with that varnished surface, the tendency of Paraplex G-40 to migrate out of the vinyl into the varnish surface is as great with Paraplex G-40 as it is with dioctyl phthalate; is that not true? A. The two blocks which show this, which are supposed to characterize the marring, are there the same for Paraplex G-40 and for dioctyl phthalate.

Q. Now, when you go over further horizontally in those two columns, under the "35%" you note three squares are green opposite the Paraplex G-40, and only two squares are green opposite the dioctyl phthalate? A. That's correct.

* * * * * * * * * *

561 The Court: Let me ask you a question in that connection. How do you account for it, if it's in the material that is used and not in the Paraplex G-40 that he's talking about, why wouldn't the same principle obtain in the G-25 up there?

The Witness: I would think, sir, that the lacquer has the bad behaviour; that is the mobile plasticizer in this case which wants to go out and stick to the adjacent film; and I would say that these tables indicate the amount of resistance that such a plasticized film gives to that tendency of the light phthalates in the lacquer to attack the film; and, in that connection, I would agree with Mr. Kinney that the nature of the medium into which the migrating material is moving is important.

The Court: On this table, in the right-hand column, with respect to Paraplex G-25, it shows only one block under the 35 per cent, while G-40 shows three times
562 that, doesn't it?

The Witness: That's right; and that means, to me, that the liquid plasticizers in the lacquer attack the Paraplex G-40 film much faster than they do the Paraplex G-25 film, and, in fact, they offer as much trouble, or even more, when the vinyl film is plasticized with dioctyl phthalate, but the worst migratory element in the system covered by this table is the plasticizers in the lacquer film.

Q. This book says nothing about that, though, does it? A. I think it indicates it: "In testing plasticizers for migration, lacquers are employed which are not particularly plasticizer-resistant."

Q. Now, really, Mr. DeBell, as I understand, what you are saying is that the data recorded here does not measure the migratory tendencies of the materials listed on the left-hand side of this table at all, but measures the migration of some supposed plasticizer from the varnish layer to the inner-face surface between the varnish and the plasticized vinyl film? A. Not precisely. I would say that this is an indication of the resistance of a vinyl chloride material

plasticized with these items on such a lacquer, and I suspect, in spite of the wording on the preceding page, that is why this table is labeled "Marring of Lacquer by Plasticizers."

563 Q. Well, do I understand that you are saying that it is still your view that Paraplex G-40 and Paraplex G-25 do not migrate from a vinyl film? A. Substantially, yes.

Q. You say it does not migrate? A. That is, their migration is so slow that, as a practical matter, it often does not take place at all.

Q. Depending on what the plasticized vinyl film is in contact with; is that correct? A. Yes; and, of course, many other factors.

The Court: Explain what the first part of the paragraph, "Migratory Tendencies," means to you. Read it out so the reporter can get it.

The Witness: "The migration of a plasticizer from an elastomer into a contacting surface apparently proceeds in a highly complex fashion, the mechanism of which is not yet fully understood. It appears, however, that the rate of diffusion of the plasticizer out of the elastomer and into the contacting material is the principal factor in migration . . ."

May I comment there?

The Court: Go on and read the sentence, and then you can comment.

The Witness: (Continuing)" . . . and is a function
564 of time, temperature, and the pressure between contacting surfaces. Compounds of very high molecular

weight, such as the Paraplex plasticizers, are of low mobility and, consequently, show quite low diffusion rates. Often, indeed, even when the plasticizer functions as a solvent for some component of the contacting surface, virtually no migration occurs as long as the plasticizer is of low mobility."

That is the end of that paragraph.

565 The Court: What did you want to explain about it? A. Well, there is a minor difference in my opinion in this because I feel quite strongly that the thing that moves normally is the light molecule and the thing that stays put or has more of a tendency to stay put is the big molecule. However, I would also agree with Mr. Kinney that the better the receiving surface, the better solvent the receiving surface is for the plasticizer, the more tendency there will be to migrate.

Q. Well, whether this book is correct or in error, on page 25 there under the heading of "Migratory Tendencies", it does speak of the migration of a plasticizer doesn't it, and Paraplex G-25 and G-40 are plasticizers? A. Not only that, your Honor, but it says from the polyvinyl chloride film into whatever it is in contact with. Now, my own belief is that the little molecule is the one that causes the trouble and the big one doesn't move very much, but this states that migration from the elastomer into the contacting surface, and it intimates that, or at least it is my opinion, that the more the contacting surface is compatible with the plasticizer, the faster the plasticizer will move into it.

Q. Well, if I understand you then, there isn't anything that migrates from the Paraplex G-25 or G-40? A. In the big molecules, no sir.

* * * * * * * * * *

569 Q. Well now, Paraplex G-25, according to the Rohm & Haas literature, has a number average molecular weight of about 8000. Is that right? A. I believe so.

Q. And Paraplex G-40 has a number average molecular weight of about 6000? A. I believe that's correct.

* * * * * * * * * *

570 Q. Do you know what the weight average molecular weight of G-25 or G-40 is? A. No I don't.

Q. Have you ever made a molecular distribution study on either of those materials? A. We have fractionated them at times, but I would not say that we had made a molecular weight distribution study.

Q. What kind of fractionations have you ever made of G-25 or G-40, just briefly? A. Separation into two fractions. I don't recall that we have ever cut more closely than two fractions.

Q. A more liquid and a more viscous fraction. Is that the basis of separation? A. A more viscous and a less viscous fraction.

571. Q. And a more liquid and a less liquid fraction? A. A more liquid and a less viscous fraction.

Q. How about answering my question. A more liquid and a less liquid fraction? A. Yes.

Q. That fractionation that you did, was that on both G-25 and G-40? A. Yes.

* * * * * * * * * *

575 Q. Have you ever seen Paraplex G-25 manufactured? A. No.

Q. Have you ever seen Paraplex G-40 manufactured? A. No.

Q. And you've never made a molecular distribution curve for either one? A. That is correct.

Q. And you have never fractionated them except to roughly divide each into two fractions? A. That is right.

* * * * * * * * * * *

579 Q. Are you familiar with the book "Principles of High Polymer Theory and Practice" by Schmidt and Marlies? A. No.

Q. Published in 1948? A. No.

Q. Are you familiar with the Flory equation? A. Yes I am. I'm not sure about the equation but I'm familiar with Flory's general remarks about—

Q. I'm talking particularly about the Flory equation on the subject of size distribution in linear condensation polymers. A. Yes.

Q. You are familiar with that? A. No.

Q. You are not familiar with the Flory equation on that subject? A. No. I'm aware of it.

Q. Now both G-25 and G-40 come in the category of linear condensation polymers, don't they? A. That is
580 correct.

Q. Now, whether you are familiar with the equation or not, let me ask you if you agree with this statement, and I'm reading from page 107 of this book: "From this equation it follows that at the conclusion of a polymerization reaction, there are more monomers present than any other size molecule". Do you agree with that statement? A. Is this the condensation reaction?

Q. This is a linear condensation reaction under the subject of size distribution in linear condensation polymers.

Now the statement I just read to you I show you in the book, and I ask you if you agree with that statement, and if you have no basis for either agreeing or disagreeing, you can tell me that? A. Yes. I do not agree with this statement as applied to the commercial manufacture of these polymers, for this reason, the commercial manufacture of these polymers is not conducted so that it can be reversible. As the reaction proceeds, the volatile products of condensation are removed and therefore it must be quite apparent that at the end of the resinification and proper auxiliary operations, there can be practically no monomer present, which is confirmed by Mr. Tierney's testimony.

* * * * * * * * * *

583 Q. Mr. DeBell, did the building unit in the G-25, the propylene glycol sebacate, have a molecular weight of about 318, or something like that? A. Well, of that order of magnitude.

Q. And the building unit of the Paraplex G-40, the propylene glycol adipate, would have a molecular weight of about that order? A. Of that order, that's correct.

Q. And, in accordance with the Flory Equation, there would be some units in there, the one-unit, the two-
584 unit, the three-unit, and all the way up, wouldn't there? A. Yes, if the Flory Equation were applicable to this product, that would be correct, but you see, by simple analytical methods, that that is not the case in these resins.

Q. But you, as I understand it, have never pursued those analytical methods? A. No. I am now speaking of the acid-number determinations, which is published specifications. You can't have, as simple computation will show, many small units with that acid-number.

* * * * * * * * * *

589 The Witness: I don't recall that. I am sure that the two plasticizers, for example, of the Oace system can be blended.

Q. And when they are blended they make a simple plasticizer system? A. Consisting of two plasticizers;
590 that's right.

Mr. Holmes: You are talking about the reissue now, not the original?

The Witness: Yes.

Q. (By Mr. Kinney) And you can blend them in advance; you can tailor-make them, can you not, to get similar results? A. Resin plasticizers of the Oace system?

Q. Yes? A. They can be tailored, and the resin plasticizers of the Oace system and the liquid plasticizers of the Oace system can be blended at any time one chooses.

* * * * * * * * * *

591 Q. Now, I understood that to get an equivalent result, using G-40 alone, you increased the proportion
592 of G-40 to 50 parts. Is that correct? A. Well, I would increase the amount of G-40, that is correct. We would have to determine by experiment whether it would have to go to 50 parts or not. I think 50 would be about right.

Q. You think that would give about a comparable result? A. I think it would give tensile and strength characteristics, which were comparable with the two component system which we just talked about, or we could use G-25 and do the same thing.

* * * * * * * * * *

595 Q. Now will you turn back to column 5 of the patent, line 21, that sentence which says: "Ethyl acrylate poly-

mer has been found useful as previously noted; this modifier has somewhat less tendency to cause tack loss than does the Paraplex G-25, hence may be used in even greater amounts in many formulations". Now if you were using the ethyl acrylate polymer with DOP, observing what we have just noted about variations in proportions with
596 G-25, how much would you increase the proportions of that acrylate to DOP in view of that sentence?

A. Well I would have to determine that of course by experiment, because so much depends on the ethyl acrylate polymer.

Q. In other words, the conventional ethyl acrylate polmers which would be somewhat comparable in physical properties to these G-25 DOP mixes we are speaking of, are the ones you would try. Is that not true? A. Yes, I would take these mixtures and merely run the Paraplex G-25 up.

Q. Or run the ethyl acrylate up? A. Excuse me, you're correct, run the ethyl acrylate up.

Q. And make a few simple tests, trying 5 to 1 ratio or 10 to 1 ratio? A. No objection.

Q. That would be a straightforward thing to do would it not? A. A very simple operation.

Q. And then would you run one more so that you would see, in view of the fact that the ethyl acrylate polymer doesn't have this surprising effect of killing tack to the extent of G-25, what would happen if you went all the way? A. Well, if I tried that and did it, I would figure that I had then found something new over the patent because
597 that has already taught me that alone the ethyl acrylate polymer does cause loss of tack.

Q. Well, it says that it doesn't cause it to the extent that the G-25 but—to the extent that G-25 of that vintage would cause it? A. Well, I read line 23 that it has less tendency to cause tack loss. Did you mean to eliminate the tack loss?

Q. In making a few of these simple tests and increasing the proportion of ethyl acrylate to 10 to 1 or higher, where you observed no significant tack loss, it would be apparent to you that you were not in trouble yet. Isn't that right? A. If we had made those experiments, and if we had made that observation, yes.

Q. And would you try 100 to 1 ratio of ethyl acrylate polymer to DOP? Would that be a fairly normal thing to do in running some of those simple tests? A. Yes.

Q. Now if you still observed no tack loss there, wouldn't that suggest to you to go that other short step and forget the DOP entirely? A. Oh, I think so.

* * * * * * * * * *

604 Q. Isn't it true that the Bierbrauer patent nowhere addresses itself to any migration problem? A. It shows that it is conscious of the effects of migration, in the statement at the end of the fifth paragraph: ". . . . and retain their pressure-sensitive properties practically undiminished without any influence on the base material by the adhesive."

* * * * * * * * * *

Q. Which paragraph, now, are you reading from? A. On your translation it is the top of page 2—" . . . and retain their self-adhering properties practically undiminished without any influence on the base material by the adhesive."

* * * * * * * * * *

. . . Now, does that tell you anything about solving the

problem of migration? A. No, it merely says that he has solved it.

605 Q. But he doesn't bother telling you how, does he? A. No.

* * * * * * * * * *

... What did Bierbrauer teach on the subject of preventing migration, that you don't find in Schmidt? A. He states he overcame it.

Q. But he doesn't tell you how, does he? A. No.

606 Q. Not a single word about it? A. That is right.

Q. He does no more in that regard than to gloss over a problem. Is that right? A. No, he states that he has solved it, in a published record.

Q. But you find nothing in Bierbrauer which tells how to solve that problem of migration? A. No. I find merely the record that it has been solved.

The Court:

Q. And on that you rely in the last sentence in that paragraph on page two? A. Certainly, sir.

* * * * * * * * * *

608 Q. Now do you know who Dr. Beavers is? A. I'm acquainted with him.

Q. Is he the chemist who was regarded by Rohm & Haas as knowing most on the subject of the Paraplex G-25 and Paraplex G-40 plasticizers? A. I think so.

* * * * * * * * * *

609 A. My understanding is that the vacuum stage of a process is for the removal of any volatile materials, or also that most of the water has come off before the vacuum stage process occurs.

Q. Well, do I understand you are taking issue in some respect with Dr. Beavers? A. Not in any material respect.

Q. Well, in any respect at all? A. I am saying that the water comes off first, that the volatiles come off during the vacuum stage.

* * * * * * * * * * *

611 Q. I understood you to say that you have never seen Paraplex G-25 or Paraplex G-40 manufactured? A. That is correct.

Q. And you don't even know the nature of Rohm & Haas' equipment used in manufacturing those products, do you? A. Yes I do.

Q. You do? Have you seen it? A. Yes.

Q. Have you ever seen the operation through? A. Not the manufacture of G-25 and G-40.

Q. Well, I just want to be sure I understand you. You do take issue then with Dr. Beavers in that statement? A. No. Dr. Beavers says he doesn't know, and I agree with him if he says he doesn't know.

The Court:

Q. If I understand you, you think you do?

* * * * * * * * * * *

612 Q. Have you ever made a study of the problems involved in making a separation on a molecular weight basis of either Paraplex G-40 or Paraplex G-25? A. No, because once the G-25 and the G-40 is made, and has been properly stripped, it is no longer distillable.

Q. So, whatever is in it cannot be separated by distillation? A. Whatever is in it when it is properly finish-

ed, cannot be separated by distillation, which I have personally verified.

• • • • • • • • • • •

620 Q. Notwithstanding Professor Flory, of Cornell University, and notwithstanding Dr. Beavers, who knows more about this subject than anybody else, at Rohm & Haas, you say you believe it's a fact? A. I'm quite sure that if—Yes, in answer to your question—I'm quite sure that if I pointed out my conclusions to Dr. Beavers, that he would accept them. I'm not aware that Flory has ever talked about G-25 and G-40.

Q. Well, he talked about linear polyesters in general, didn't he? A. I know.

• • • • • • • • • • •

623 Q. Now, these plasticizing materials we have been talking about in connection with this Oace patent in this plastic tape, when they plasticized the vinyl chloride polymer or copolymer, it is a physical plasticizer. Is that correct? A. Yes.

Q. And in respect to this problem of migration, portions of the plasticizer migrating from the vinyl film to the adhesive layer, that is a physical function again is it not? A. Yes.

• • • • • • • • • • •

626 Q. Does DOP have any distinctive odor; can you recognize it? A. I think hot, yes; cold, it doesn't have much odor.

Q. Well, at the temperature of your oven which I believe you said was—A. 105 Centigrade.

Q. That would be above the boiling point of water? A. I think I would recognize it as a phthalate, perhaps not necessarily as DOP.

Q. There wouldn't have to be very much of it in the atmosphere for you to be able to notice it; there need be relatively few molecules floating around to affect the sense of smell; isn't that right? A. It would not take very much to be smellable. You can get some idea, of course, by the intensity of the odor as to whether there was much or little.

* * * * * * * * * *

627 Q. Now plasticized vinyl films absorb water, don't they, in more or less degree, depending upon the plasticizer system employed? A. In my opinion, these films adsorb water.

Q. All right, adsorb. And that varies from film to film, depending on the plasticizer employed? A. That's possible.

Q. And, in the oven test that you make, one thing you do is to drive off water that has been adsorbed? A. That's right.

* * * * * * * * * *

628 Q. Well, I understood, at page 501 of the transcript, that you were taking issue with the reliability of Mr. Tierney's sample. Am I in error on that? A. I am not taking issue; I am merely saying that it contains a volatile material, a highly volatile material.

Q. And can you identify the highly volatile material? A. We made no effort to, beyond noticing that there was a strong ethyl acrylate odor and that the material was volatile.

Q. Well, you would expect an ethyl acrylate odor with an ethyl acrylate plasticizer, wouldn't you? A. Not if it were highly polymeric.

Q. Well, don't you, with those kinds of polymers, always

get some odor at higher temperatures? A. This wasn't at higher temperatures; this was at room temperatures. I smelled the sample right here in the court room.

Q. And you noticed an odor here in the court room? A. Yes, at the time when we had the previous hearings. That is why we went to this trouble. The odor was strong enough to lead me to wonder if there were not monomer present.

Q. Well, can't you detect an odor with dioctyl phthalate plasticized vinyl film at ordinary room tempera-
629 tures? A. Oh, it is detectable, but very faint; and, if the film has any age, it is undetectable.

Q. But ordinary, vinyl goods, like raincoats, they have a very distinctive odor, don't they? A. Yes.

Q. So that doesn't mean that anybody left some volatile solvent in the raincoat, does it? A. No.

* * * * * * * * * *

633 Q. Now with a material like dioctyl phthalate at a temperature of 80 degrees C. in these 4-mil films, there will be a weight-loss of about one per cent per day; is that correct? A. That's right.

* * * * * * * * * *

634 Q. Now how would the molecular weight of dioctyl phthalate or dibutyl sebacate compare with the weight of the monomeric ethyl acrylate? A. Those are much heavier than monomeric ethyl acrylate.

Q. Now you would expect, therefore, that the monomeric ethyl acrylate would be lost even more rapidly under those conditions of elevated temperature in films of that type? A. Yes, with due allowance for the amount of ethyl acrylate that's in. If, for example, you have 35 percent of

ethyl acrylate monomer in the film, I would expect that the loss would be more rapid than these curves.

• • • • • • • • • • •

635 The Court: You are now smelling what exhibit?

The Witness: Exhibit T-20, Paraplex G-40 has a very slight odor.

Q. (By Mr. Kinney): Now does that indicate that there is some very low molecular weight material in that Paraplex G-40 to you? A. That indicates that there are enough molecules of low molecular weight material to be sensible to the nose, and I would say that there might be as much as one one-thousandths of one per cent, at a guess. That is not an analysis, but a range one way or another of some odor body.

Q. So, just in the same way as you detected some smell from this Tierney ethyl acrylate tape, you detect some smell from the Paraplex G-40? A. I do.

• • • • • • • • • • •

645 Q. Now down in that paragraph there you will see the statement: "Research investigators, therefore, focused their efforts on tailoring plasticizers to meet specific, often stringent, application and process requirements." You notice that? A. Yes.

Q. Do you agree with that? A. Yes.

Q. And later it says "Compounders of vinyl products are now able to choose from a variety of plasticizers ranging from simple monomeric esters to complex, high molecular weight polymers such as the Paraplex series of polyesters." Do you notice that statement? A. Yes.

Q. And that is a correct statement, is it not? A. Yes.

• • • • • • • • • • •

648 Q. Does not Dr. Reed have a very favorable reputation in scientific circles for his knowledge in the field of polymers? A. I think he is well informed.

Q. I would like to refer to Dr. Reed's deposition which is part of the New York Depositions taken on April 20 and 22, 1955, page 20 of the Reed deposition—

• • • • • • • • • • •

Q. I show you my copy. I refer you to Dr. Reed's testimony at page 20, where he said—well, there was a
649 question up here at the top which reads: "Let's assume that they have dissimilar chemical characteristics in a different molecular weights. Can you predict with any degree of assurance what their behaviour will be in polymers or admixed with polymers?" Then there is some colloquy and then there is this answer: "A. In comparing materials which differ both in chemical composition and in molecular weight, the molecular weight value only would give very inadequate information for predicting properties." Do you agree with that answer? A. Yes.

• • • • • • • • • • •

651 Q. Will you turn first to the Groff patent. Now, it does not disclose anything in respect to pressure-sensitive adhesive tape, does it? A. No. This deals with the vinyl, stretchable plastics, and plasticization.

• • • • • • • • • • •

652 Q. That rainwear was made generally like these vinyl films described in this patent, was it not? A. It was, in that it used vinyl resins, but it used higher molecular weight vinyl resins, and it used different plasticizers in the rainwear, but still of the same general nature and for the same purpose. The ratios were a little different from these examples.

Q. One of the purposes described in this Groff patent as I read it, is to make moisture-proof packaging films. You noted that in there didn't you? A. By that I presume you refer to example 10?

• • • • • • • • • •

653 Q. But there is nothing there in respect to how to make a pressure-sensitive tape. Is that correct? A. That is correct.

Q. Now, will you refer to the Drew patent, No. 2177627? A. Yes I have it.

Q. Does that mention vinyl resin backings in connection with pressure sensitive tape? A. I'm glancing hurriedly through this. I do not notice a vinyl film example or reference.

• • • • • • • • • •

654 Q. Well now, first of all, the patent has nothing to do with vinyl films at all does it? A. That's correct.

Q. And therefore it has nothing to do with migration of plasticizers in vinyl films? A. That is correct.

655 Q. The film primarily stressed in making the tape of the patent you have before you, is plain transparent Cellophane is it not? A. Yes. On page 2, the first column, line 16—excuse me. That's waterproofing cellophane. Yes, you're correct.

• • • • • • • • • •

656 Q. All right, now let's turn over to the Maibauer patent, and if you look at page 3 of that patent, beginning in line 16, you will see this sentence: "Thus the tape is characterized by such a dry surface at room temperature that it does not adhere to a person's hand and can easily be wrapped on a rack, yet at elevated temperatures,

say from 100 degrees C. to 140 degrees C., or when wet with an adhesive or a solvent for the low molecular weight polymer, one surface of the tape will seal against an overlapping tape surface effectively to prevent leakage of the electrolyte between the two surfaces." You notice that wording do you not? A. Yes I do.

Q. Now, you don't say that this patent concerns making a pressure-sensitive adhesive tape do you? A. No. This merely tells us what we should use for the backing of such a tape.

Q. Does the patent purport to teach how to make backing for pressure-sensitive adhesive tape? A. No, it teaches a type of composition which would be suitable if one wanted to make a stretchable, retractable vinyl backing for such a tape.

657 Q. How does Maibauer plasticize the vinyl film? A. Among other things he mentions, on page 2, the second column, line 65, as plasticizers in the next ten lines, triphenyl phosphate, organic phthalates, and organic phthalates.

Q. And he illustrates some of those organic phthalates does he? A. Yes.

Q. Are all of his plasticizers of the migrating type, as you view that denominant? A. Yes.

Q. Well, he doesn't help you with the backing for making pressure-sensitive vinyl plastic tape does he? A. He doesn't help us with a solution of the migration problem but he does tell us generally what type of resin and plasticizer may be used for initial trials.

Q. He doesn't suggest that you even use those for initial

trials in making pressure-sensitive tape does he? A. No, just tape. Wrapping tape.

• • • • • • • • • • •

Q. Now, will you turn over to the Sears patent,
658 2413673. Do you have it before you? A. Yes.

Q. Now, does that patent have anything to do with pressure-sensitive adhesive tape of any kind? A. This has primarily to do with tape, vinyl tape, without pressure-sensitive adhesive, although he brings into the constructions, inner coating of the nature of the coatings used in pressure-sensitive adhesives, at least containing rubber, column 3, line 5, so that he would suggest materials of the type which have since proven useful in adhesives of the pressure-sensitive type.

Q. Which part of the patent are you referring to? A. I am referring to column 3, line 4, "An inner coating of such insulation as asphalt, pitch, rubber or other material may be used in combination with an outer insulation of my new composition."

Q. The whole patent is concerned with insulating electrical conductors is it not? A. Yes.

• • • • • • • • • • •

659 Now, the only other cited patent which I believe
660 you talked about in your direct examination was the Bierbrauer Swiss patent that we've been over? A. Yes. At least we did talk about that patent.

Q. That patent says nothing about making an electrical tape does it? A. I think it does. Just one moment. I don't find a reference to electrical tape in Bierbrauer.

Q. I think we've already been over this, that the Swiss patent expresses an appetite but leaves you on your own

to satisfy it. Is that right? A. Well, it says that the patentee has satisfied his appetite, but he leaves you to your own natriment.

• • • • • • • • • • •

662 Q. Now Mr. Harris, as the record will show, asked Mr. Danovitch: "Make me a roll of plastic tape." This was in the summer of 1948. Had Mr. Harris asked you to: "Make me a roll of plastic tape", how long do you feel it would have taken you to do it?

The Court:

Q. Can you answer that now without the aid of some of the knowledge you have gained since then? A. I don't know, but I'll do the best I can, your Honor. I would say, without knowing the pressure-sensitive art—now remember, I did know at that time, the vinyl art,—but without knowing the pressure-sensitive art, I would say that it might take me somewhere between six weeks and four months.

• • • • • • • • • • •

664 A. A resin is a synthetic or natural material which is viscous or solid at normal temperatures, at room temperatures, that has some appearance characteristics—I can't do that. I was going to compare it to rosin but I can't limit it to that, and which has some amorphous characteristics. Even that is not a good definition because stretched polyamid is a resin and it—it still has some amorphous characteristics.

Q. Are some resins crystalline? A. Yes. There are crystalline elements, especially in oriented synthetic resin. The abietic acid which we take out of resin, can be crystallized. Whether it's resin by the time it's taken out or not,

I should hate to specify. At least there is an amorphous characteristic or a possibility of it with the materials that I am thinking of.

Q. Are resins necessarily polymeric or may they either be polymeric or non-polymeric? A. No. Resins got their name from the Naval Stores industry and there are at least some monomers involved there or monomers can be
665 made from such materials.

Q. So they need not necessarily be polymers? A. No. They usually are.

* * * * * * * * * *

A. A plasticizer is a material added to high polymers, to adjust the physical characteristics primarily with regard to temperature.

Q. Or to modify the flexibility of such materials? A. Yes, but most of those materials at a higher temperature may well be flexible, and it brings down—in many cases it brings down the flexibility characteristic to room temperature.

Q. Now will you define polymer please? A. Polymer is a chemical material which contains recurring units.

Q. May you have high molecuar weight polymers and low molecular weight polymers? A. Yes.

666 Q. May you have polymers which are resinous or non-resinous? A. I'm trying to think of polymers which are non-resinous. I presume there are some. I presume, yes.

Q. Now next will you please define ester? A. An ester is a chemical material which contains the linkage bond CO bond OC bond.

Q. May it be defined perhaps a little easier for the average person by saying it is the reaction product of an organic acid and an alcohol? A. That is proper.

Q. Now in the ester field, not all esters are plasticizers are they? A. No.

Q. Many, many esters are not plasticizers. Isn't that correct? A. Yes.

Q. When you talk about esters which are plasticizers, you confine yourself to just one segment of the field of esters? A. That is correct.

• • • • • • • • • • •

667 A. A polyester is an ester which has recurring units of the same type in the molecule.

Q. The next question, do you have a theory as to why the Paraplex G-25 of 1944 and 1945, would not work as the sole plasticizer in making up a pressure-sensitive stretchable and retractable tape? A. No. It is my opinion that that plasticizer makes a perfectly good tape.

Q. But you didn't try it at that time did you? A. Not at that time.

Q. And you have never made a tape with it since have you? A. Yes.

Q. Well, I misunderstood you yesterday then. I understood you had not? A. I have made tapes from, as you heard, samples of G-25, of 1945, 1951 and current.

Q. Pressure-sensitive adhesive tapes? A. No. Those were the vinyl tapes.

Q. But you never made any pressure-sensitive adhesive tape with the G-25 of 1944 or 1945 at any time have
668 you? A. No, that is correct.

• • • • • • • • • • •

Re-cross Examination

By Mr. Harold J. Kinney:

* * * * * * * * * *

676 Q. Now you say you have been a consultant for Rohm & Haas for a period of time. Can you fix a little more accurately when you commenced your consultantship? A. I believe it was in 1946.

Q. Can you fix the time of the year? A. I can't, I'm sorry.

Q. You don't know whether it was the beginning or the end of the year? A. I don't remember.

Q. Did your consultantship ever concern the manufacture of the linear polyesters? A. Yes, but not G-25
677 and G-40.

The Court: Could you state the frequency with which you were consulted by that firm over this period of ten years?

The Witness: Ordinarily I go there regularly, oh, every month or every two months.

The Court: Is that true for the past ten years?

The Witness: Yes, sir.

The Court: Are you consulted with respect to this type of tape at all?

The Witness: On tape, not at all.

* * * * * * * * * *

678 Q. Now do I understand that you are not personally familiar with the manufacturing procedures in respect to any of those Paraplex plasticizers that we have just identified? A. I would so say.

Q. Now I understood you to say in your redirect there were no migrating problems in this tape that we are talking about? A. Yes. I was referring there to the tapes which are now on the market in large quantity in which the migrating problems have, in my opinion, been solved.

Q. You say there are no migrating problems because the problems have been solved; is that what your ans-
679 wer meant? A. In the tapes which are here under discussion, that's correct.

The Court: I am assuming that, by that answer, you mean that there were migrating problems involved until they were solved.

The Witness: Of course, Your Honor, there were grave migrating problems until they were solved, but that is all over now.

• • • • • • • • • • •

Defendant's witness **Walter M. Bieringer:**

Direct Examination

By Mr. Hector M. Holmes:

• • • • • • • • • • •

682 Q. Do you know if there were samples of it in your factory; did you have a sample; did you see one? A. Oh, I'm sure that I had occasion to see samples as I went around.

Q. And do you remember if the subject-matter was discussed by you with other officers of the company from time to time? A. Yes, I feel certain that I discussed it with the President of our company so that he would know about it, and I discussed it many times with our sales force through-

out the country when they came to the plant or when
683 I was out, because naturally they ran into it also.

• • • • • • • • • • •

684 Q. Did you then instruct them to go right forward and make a good, merchantable tape? A. I wanted them to make one as soon as they could.

Q. Were your first samples satisfactory, that you got from the factory end? A. No, from the point of view of appearance, they were rather poor, I thought.

Q. And was the poor appearance, as time went on, rectified? A. Yes, but it took quite some time.

• • • • • • • • • • •

691 The Court: The objection of plaintiff to the introduction of this letter bearing date August 23, 1950, on the ground that Danovitch, to whom it was addressed, was specifically inquired of concerning it and that he stated definitely that there was no such correspondence for the period between 1948 and 1950, and counsel for the defendant not having notified the plaintiff of the discovery of the letter until it was offered in evidence here near the end of the trial, the Court sustains the objection on the ground that it has the effect of taking the plaintiff by surprise and giving it no opportunity now to prepare to meet the situation; and the defendant excepts to this ruling.

Now you can let it be marked to go in the record, if you want to. You can leave it here, but I am going to
692 exclude it on that ground.

Mr. Holmes: Yes, sir, I will have it marked for identification, Your Honor.

(The document referred to was marked as Defendant's Exhibit 68 for identification.)

• • • • • • • • • • •

Cross Examination

By Mr. Harold J. Kinney:

• • • • • • • • • • •

700 Q. What were the sales on this tape in the year 1950, to the best of your recollection? A. May I ask
701 a question your Honor? Did you say that I had to answer as to our volume, as we never wanted to tell our competitors what our volume was?

The Court: I can't help it. You are now involved in a case which makes it necessary. A. All right, sir. I have some figures here. I haven't got 1950. I might say this, that 1950 and 1951 were so small that we didn't bother with any figures. It amounted to practically nothing. It was very, very small, and my sales figures, I have not got my sales figures. I have the amount of poundage mixed for those years.

Mr. Kinney:

Q. For 1950 and 1951? A. No.

Q. For 1952 and 1953? A. Yes, sir.

Q. Would you give us those figures, and Mr. Holmes will have the sales figures, I assume?

Mr. Holmes: You know we haven't got the sales figures for 1951, 1952 and 1953. We've been into that a hundred times in Boston. We had our witnesses and you examined them, and the production figures were destroyed in the regular course of business for those years, and we had our poundage figures.

The Court: Go ahead with 1952 and 1953.

702 A. In 1952 we mixed 150,736 pounds. In 1953 we mixed 228,532 pounds.

Mr. Kinney:

Q. Now in that 1952 production, can you roughly translate that into sales for us? A. Well, I would say that it's under $400,000.00 in 1952 and in 1953 it was more, so that would be around a half million dollars.

Q. And 1951 and 1950 were very small? A. Practically nothing.

Q. Did you have any sales at all in 1950 that you know of? A. Probably at the very end of 1950 we had some sales in small quantities, but very small. A hundred rolls here and there.

* * * * * * * * * *

Defendants' Witness **Frank L. Kozol:**

Direct Examination

By Mr. Hector M. Holmes:

* * * * * * * * * *

708 The Court: I can't see how his getting insurance
709 or not getting insurance really has anything to do with the Plaintiff's failure to act, or laches on the part of the Plaintiff. You don't have any way of showing that this was communicated to the Minnesota Mining people?

Mr. Holmes: Oh no.

* * * * * * * * * *

714 Q. Well now, when was this insurance taken? A. The insurance was taken out in the Fall of 1950.

Q. In the fall of 1950? A. Yes sir.

* * * * * * * * * *

717 Q. In other words, you carried it a year after you knew that you were not infringing, according to these reports? Yes sir.

Q. Did you change the policy? A. No sir.

Mr. Holmes: Two years.

Q. Your first policy was against named patents, wasn't it? A. We only had one policy sir, and that was against named patents.

Q. It named a group of patents, among which could not have been the patent in suit? A. That's right, although the patent in suit was added to that policy.

Q. Carried for a year? A. Two years.

Q. Carried for a year after you knew about the patent? A little over a year? A. It was carried from the late summer or Fall of 1951 until the Fall of 1953.

• • • • • • • • • • •

718 Q. You got one from Fish, Richardson and Neave, and then you got one from the Kenway firm when you took out insurance, and then you got another report? A. I got two others in 1951, one from Fish, Richardson and Neave and one from Kenway on the patent in suit. That was in 1951. We then carried that insurance for two more years and then cancelled it.

• • • • • • • • • • •

Defendant Rests

No rebuttal testimony offered by plaintiff

• • • • • • • • • • •

EXCERPTS FROM DEPOSITION TESTIMONY

Depositions taken by Plaintiff in Boston, Massachusetts, commencing February 9, 1955

Excerpts from deposition of **Morris M. Danovitch,** chief chemist of Plymouth Rubber Company, Inc. since July, 1924:

Direct Examination

256 Q842 Now you say you may have looked at some of this Minnesota Mining literature and examined the "Scotch" Brand No. 33 electrical tape before you started your laboratory work, perhaps somewhere around the late spring of 1948? A. Yes. When I said Minnesota data, I had reference to the pamphlet that Carbide & Carbon put out.

Q843 At around that time? A. Yes.

Q844 What was the nature of that pamphlet? A. It was one of their circulars that they put out called "Kabelitems." It is a sheet they put out periodically. They mention products that are on the market. It is about letter-size like those things are.

Q845 Do you have a copy of that pamphlet? A. Not with me.

Q846 Do you have it at your office? A. Yes.

Q847 Now that is something that you had at the time this project was born at Plymouth of going into this pressure-sensitive plastic tape business? A. I have it in my files.

Q848 At that time? A. Yes.

• • • • • • • • • •

258 Q855 Let us correct it. Is there any doubt about that? I understood you to say that you did have rolls of "Scotch" Brand No. 33 electrical tape there when this idea of going into this plastic tape business was born at Plymouth Rubber Company? A. Yes.

Q856 That is what I thought the answer was. A. Because I told you the other day that it was readily procurable.

• • • • • • • • • • •

504 Q2028 Have you been receiving literature from Rohm & Haas on various plasticizers for vinyl chloride resins since the year 1944 or earlier? A. Yes.

Q2029 Now I understood you to say in your earlier testimony that in some of your experimental work in connection with this pressure-sensitive vinyl plastic tape you tried out some mixtures of Paraplex G-25 and dioctyl phthalate in the plasticizing of vinyl chloride polymers, is that right? A. Yes.

• • • • • • • • • • •

506 Q2036 You say that you tried that particular blend of ingredients in the plasticizer because of difficulty with G-25 alone? A. Yes.

Q2037 And the difficulty was that the G-25 didn't disperse readily? A. We couldn't process it readily. We always had trouble mixing G-25.

507 Q2038 Do I understand that in relatively recent times you have been able to successfully process vinyl resin plasticizer with G-25?

Mr. Kirkpatrick. Alone, you mean?

Mr. Kinney. Alone.

A. Yes.

Q2039 But you were not able to successfully process G-25 and VYNW or VYNS in 1948? A. No, we were not. We always had difficulty, always had trouble with it.

Q2040 Now did the liquid plasticizer, when present in a less amount than the G-25 in your experimental work, make it possible for you to process such material? A. No.

Q2041 It didn't help the situation? A. No.

Q2042 And you tried varying proportions? A. I don't recall.

• • • • • • • • • • •

526 Q2127 Now I just have a couple of summary questions here, Mr. Danovitch. When you started in on this project back in '48 in this your testimony, that the only things you had to guide you then in your work were this Bakelite pamphlet, Plaintiff's Exhibit 17, sample rolls of "Scotch" electrical tape No. 33, and your prior knowledge of plasticizers and vinyl resins? A. I object to the word "guide." I had that, but I wouldn't say that it was my guide.

Q2128 Well, I will break down the question. Referring to this Plaintiff's Exhibit 17 for identification, particularly to page 2 where the properties of various "Scotch" brand plastic electrical tapes are given, including various properties of No. 22 and No. 33 tapes, weren't you trying to duplicate tape with those properties when you started out? A. I wasn't trying to duplicate it. I was trying to make a similar product.

• • • • • • • • • • •

Depositions taken by Plaintiff in New York City, New York, commencing April 20, 1955

Excerpts from deposition of **Paul Shalita,** Technical Director and Vice President of Technical Tape Corporation:

Direct Examination

73 Q. What effect would the film have on the adhesive that was significant? A. There are many. One, you have a problem of anchoring the adhesive coat to the film. Two, you have the possibility of plasticizer migrating to the adhesive as used on the film. Third, you have—that's all in relationship to the effect of the film on the adhesive.

Q. What is the effect with respect to the adhesive on the film? A. Again you have the problem of materials from the adhesive migrating to the film, and the problem of anchoring the adhesive to a given film.

74 Q. Was this plasticizer problem the most acute one as you saw it? A. Generally, yes.

• • • • • • • • • • •

Q. You did have the effect that sometimes your adhesives went virtually tack-free in some of the tests you made? A. Yes.

Q. What did you attribute that to? A. This would only be my personal observations on it. I felt that the adhesive had a greater compatibility for the plasticizer in the
75 vinyl film than the vinyl resin itself did, and, therefore, the adhesive would cause an oozing or an exudation of the plasticizer from the vinyl film.

• • • • • • • • • • •

Redirect Examination

98 Q. Do you know that some of the most common forms of vinyl chloride polymers or copolymers have been on the market since the mid 30's or earlier? A. I don't understand what you mean by "common forms."

Q. Common trade designations, some of the more popular ones. A. I can think of two that are, I'd say, in the late 30's. One would be "Vinylite."

• • • • • • • • • • •

99 Q. In your examination by your counsel, I understood you to say that hundreds of materials can be used as plasticizers for polyvinyl chloride. Did I correctly hear you? A. I think I said I thought there could be hundreds. I wasn't certain of the number, but there were many.

Q. Have you known that to be a fact for quite a period of time? A. Well, I have known that many—and
100 again I cannot say whether it is hundreds—but many materials can be used as plasticizers for polyvinyl chloride or its copolymers.

Q. Was that knowledge in the art just recently or for quite some time? A. Oh, I think it's for quite some time.

Q. For how long a time, 15 years, 10 years, 5 years? A. If we don't limit it to hundreds but to many, I would say approximately 15 years.

Q. Could you name some of the major plasticizers among the many that were known 15 years ago?

Mr. Spille: I don't know what you mean by "major". I think that's not clear.

Mr. Kinney: Well, any that are known to the witness. A. Various phthalates, such as dioctyl phthalate.

• • • • • • • • • • •

101 Q. In referring to these many materials which were available to plasticize vinyl chloride polymers or copolymers fifteen years ago, some of them were
102 liquid materials and some of them were resinous materials, is that right? A. Yes.

• • • • • • • • • • •

Excerpts from deposition of **Marion C. Reed,** chemist employed by Bakelite Company:

Cross Examination

17 Q. When you say it is presumed to have a higher molecular weight, you have some basis, I'm sure, for that presumption. Could you estimate roughly the order of the molecular weight of these two resins? A. I would hesitate to do so because experts on the subject have differed by a factor of 2 in their assignment of molecular weight values on the basis of viscosity.

• • • • • • • • • • •

20 A. In comparing materials which differ both in chemical composition and in molecular weight, the molecular weight value only would give very inadequate information for predicting properties.

Q. Is a resinous material necessarily liquid or solid? A. It may be either.

Q. And is a polymer necessarily liquid or solid? It may even be gas? A. It may be liquid or solid, but I know of no gases which might be considered polymers.

• • • • • • • • • • •

33 Q. I'll try to be more specific. Among the plasticizers which have been used commercially in vinyl films, I'm confining myself to the monomeric type, can you tell us what the range of molecular weight of such monomeric plasticizers has been? Let's take the lower limit first. A. The lower limit would be in the range of approximately 400.

Q. That's the lower molecular weight for monomeric plasticizers? A. Yes. Below that most materials would be too volatile to be commercially satisfactory.

Q. What would be the upper limit? A. We come there to a controversial point on what is polymeric and
34 what is monomeric, and that cannot be answered in one sentence. Perhaps you can lead up to it in some manner.

* * * * * * * * * *

35 A. Give me a moment. Without resorting to a search of the literature or calculation of molecular weights, a figure in the vicinity of 1000 is as high as I could recall as being a monomeric plasticizer. There may be others above that that I don't think of at the moment.

* * * * * * * * * *

36 Mr. Spille: I was asking about a monomeric plasticizer having a high molecular weight, what is the highest.

* * * * * * * * * *

Q. Did I make myself clear in this colloquy what I was asking for? Was your answer based on the same understanding? A. I understood it as you stated it. I am not at the same time saying that that is a dividing line between monomers and polymers.

Q. I understand that. You are picking, now, a range, and your upper limit is certainly within a safe limit.

* * * * * * * * * *

Q. The answer to my prior question wherein you indicated that a molecular weight of about 1000 was about the upper limit of plasticizers for vinyl films which you can unhesitantly characterize as monomeric. You picked number 1000 as being a safe number, not open to debate, whereas you recognize that there are materials of higher molecular weight than 1000 which may or may not be monomers. A. I think you are restating my answer in a somewhat different manner. I intended to convey that I believe that examples of monomeric plasticizers could be found as
37 high as 1000 in molecular weight. But I do not believe that that constitutes any division line.

* * * * * * * * * *

Depositions taken by Defendants in Philadelphia, Pennsylvania, commencing March 21, 1955

Excerpts from deposition of **Louis Klein**, chemical executive and vice president of Rohm & Haas Company:

Cross Examination

134 A. Well, normally, for instance, when we start manufacturing a new product we set up a range of specifications that are a compromise between what the sales department and the laboratory want on one hand and what the manufacturing department thinks it can produce on the other hand. And such specifications as acid number, viscosity, color, are drawn within as wide limits as is considered feasible to give manufacturing latitude. As we obtain experience there is a tendency to narrow those limits as experience shows that it can be done, or as manufacturing improvements are made that make it possible to do

that. After all, we are talking about resins, we are not talking about chemical compounds, and they are defined by the specifications which we set.

XQ400 Did a similar situation apply in respect to Paraplex G-25? Were those specifications narrowed as your manufacturing experience progressed? A. Again I think that is a better question to put to Mr. Blount, but I would suspect that that is probably what happened, because that is almost normal in the development of a new resin.

XQ401 But except for those narrowing of specifications, basically G-20 is the same today as it was in 1930 or 1935? A. I would say so.

* * * * * * * * * *

A. I would say that where a product is rather new and rather different, normally we would expect to narrow our specifications after commercial experience. That would be less likely to be the case with a material very similar to something we made before or something on which we had experience.

XQ416 Well, now, was G-25 the type of material which you would expect that there would be some narrowing of specifications on? A. Yes, it was because it was substantially different from anything that we had made before.

XQ417 And you first offered G-25 in the latter part of '43, is that right? A. That is the best of my recollection from the reference to our sales literature.

* * * * * * * * * *

XQ424 Is material having a molecular weight around 1,000 a polymer? A. It could be, depending on the material.

XQ425 Let's talk about a material such as G-25. A. My impression is that—at least I have always thought of it as not having material as low molecular weight as that in it.

XQ426 Do you know anything about the range of molecular weight in G-25, as your company first put it on the market? A. No, I do not.

• • • • • • • • • • •

Excerpts from deposition of **Ellington M. Beavers,** laboratory head in research department of Rohm & Haas company:

Direct Examination

160 Q29 What was the nature of your work, so far as it concerned G-25, in late 1943 and '44? A. Late '43 and '44.

Q30 At the beginning of G-25. A. Well, at that time our work dealt solely with the development of a process for the manufacture of G-25, both on a pilot-plant and a plant scale. By that time the G-25 composition had been defined research-wise at least with respect to its major features.

• • • • • • • • • • •

162 Q43 In connection with your work with G-25, did you have occasion to use therewith a momomeric
163 plasticizer in polyvinyl chloride or polyvinyl chloride-acetate copolymers? A. Not that I recall. Our primary objective was to evaluate our plasticizers alone and singly in polyvinyl chloride, and I do not recall any work with combinations of plasticizers.

Q44 Do you know whether or not such a mixture of plasticizers was contemplated early in the use of G-25, perhaps for saving expense or for other reasons? A. Contemplated by whom? By us or by a customer of ours?

Q45 Yes, by Rohm & Haas. A. I don't know, no.

Q46 I ask you that because there appears to be in a letter of October 26, 1943, included in Exhibit 49 herein, a reference to employing Paraplex AR-148 in conjunction with a small amount of an ester-type plasticizer.I ask if that refreshes your recollection as to anything that was discussed or that was done at that time on that subject. A. Where is the reference to monomeric—oh, yes.

Q47 Do you find such a reference in that letter? A. Yes, sir. That does not refresh my memory as to any work we did of this kind, no. I am afraid I don't know what
164 Dr. Myers had in mind at the time of that letter. I have not seen this letter since 1943, if I saw it at that time.

* * * * * * * * * * *

165 A. Well, I remember that our first production scale batch of G-25 was made in early 1944. I believe that is about as close as I can come to it. I believe it had been made by the 1st of May.

* * * * * * * * * * *

175 Q84 Would you expect them to be alike? A. I think they are pretty similar from the fact that their average molecular weights are so close together. But we have no data on the relative amounts of molecular weight fractions in either case.

Q85 There certainly would be no monomeric material in either of those compositions as sold? A. I can't say that. Particularly I don't believe I know what you mean by monomeric.

Q86 Well, suppose we draw a line of molecular weight material of the order of two, three, 400. Would not your

distillation and checking procedures tell you that there were no such materials included in your products as sold? A. They would not tell us that exactly, no.

Q87 But whatever might be the case with one you say would be the case with the other? A. The two should be quite similar.

Q88 Did you ever fractionate G-25, or attempt to fractionate it? A. We have made attempts along those lines but unsuccessfully. We have never described a dis-
176 tribution curve as a result of our work on fractionation.

Q89 And that is true as to each of those materials, G-25 —A. G-25 and G-40?

Q90 Yes, sir. A. I am glad you asked that. I am not sure that it is true of G-40. I am not sure we have done anything with G-40, come to think of it. To the best of my memory, what we have attempted to do has been with G-25 alone. I think we have not even attempted to fractionate G-40.

• • • • • • • • • • •

190 A. The vacuum stage of the process for the preparation of G-25 has as the purpose the removal of free glycol and water which may result from the polyesterification.

By Mr. Kirkpatrick:

Q114 Is that conducted at a temperature which tends to remove lower molecular weight material? Are the conditions such that it tends to remove lower molecular weight material? A. I am afraid that in order to answer that I would have to know how low you mean. That is a matter of interpretation, it seems to me.

Q115 Well, suppose we say material of the order of three, four, 500 molecular weight. A. I don't know that it would remove anything that high in molecular weight.

* * * * * * * * * *

Cross Examination

210 XQ191 Well, it is never quite 100 per cent, is it? A. No, I am sure that it is not a chemically-pure compound.

XQ 192 Have you observed that in Paraplex G-25 as sold by your company a usual situation is that the otherwise clear material contains some small amount of mushy solid? A. At what temperature?

XQ193 Room temperatures. A. I have never observed that, no, sir.

XQ194 Have you noticed some cloudiness in G-25 as distinguished from a completely clear product? A. Not in a batch which had been properly filtered.

* * * * * * * * * *

216 Can you tell us whether Paraplex G-25 as commonly sold by your company is more than 99 per cent an ester of sebacic acid or less than 99 per cent of an
217 ester of sebacic acid? A. No, sir, I cannot tell you that.

XQ223 Can you tell us whether it is more than 95 per cent of an ester of sebacic acid? I mean, one or more esters. I am not being technical on that. I mean of an esterified sebacic acid. A. We haven't determined any such figures experimentally. We react together sebacic acid and the glycol and our product is the polyester derived from those two raw materials. Any deviation from 100 per cent pure sebacate ester would be the result of any impurities that there might be in the raw materials.

* * * * * * * * * *

Excerpts from deposition of **Arthur L. Blount**, chemical engineer of Rohm & Haas Company:

Direct Examination

240 Q9 From a letter of January 11, 1944, contained in Defendants' Exhibit 14, for identification, it appears that G-25 was offered for sale as early as said date. I hand you that letter. Can you say whether by said date you were manufacturing G-25? A. I believe that this is before the material was produced in the plant.

Q10 From that do I gather that prior to that time it was produced on a pilot-plant basis? A. I would say that, yes.

Q11 How long did it continue on a pilot-plant basis, if you know? A. The first plant production was in April of 1944.

• • • • • • • • • • •

Cross Examination

251 XQ44 In plant production when you talked about working within specifications, sometimes you may be just barely within the specifications and sometimes you are well within the specifications, isn't that right? A. Yes.

XQ45 And in normal production the objective is to narrow the specifications or, I mean, to stay well within the specifications as much as you can, isn't it? That is the normal objective in production? A. Well, that is
252 certainly nice when you are right in the middle of a range, as far as that is concerned, and that is what we try to do, that is, is to get right in the middle of the range.

XQ46 And as you develop more production experience with the new product, you do try to stay well within the specifications? A. Yes.

• • • • • • • • • • •

Depositions taken by Defendants in Boston, Massachusetts, commening June 9, 1955

Excerpts from deposition of **Robert W. Lundbohm**, chemist employed by plaintiff:

Proceedings before Judge Ford

55 Mr. Holmes. He can't pass upon it until he knows what the material is.

The Court. I will never have occasion to do so, Mr. Holmes, because there is no case pending here.

Mr. Holmes. Well, there must be some basis upon which the local judge must order a witness to answer.

56 The Court. I can compel the witness to answer the question without doubt under the rules, but he is going to give the answer that he does not know. Now where are we?

• • • • • • • • • • •

59 The Court. The other thing is the witness knows nothing about these documents, does he?

Mr. Kinney. He originally wrote this document back in 1951.

The Court. So he ought to know what is underneath there.

Mr. Kinney. He writes many of these documents, your Honor.

The Court. Did he know at one time?

Mr. Kinney. I don't know. I suppose he did.

The Court. Did you know at one time?

The Witness. At the time in 1951.

• • • • • • • • • • •

Depositions taken by Defendants in Bridgeport, Connecticut, commencing April 7, 1955

Excerpts from deposition of **Irving C. Eaton**, engineer employed by General Electric:

Cross Examination

28 Q. Now, at some stage General Electric was asked to work specifically on the problem of jacketing around a polyethylene insulated cable, was it not? A. It must have been.

Q. I mean, there was a government project on that, was there not, in which Federal Telephone and G.E., and various other companies were jointly engaged? A. Yes, if I remember correctly. There was the problem which
29 was put up to the cable industry, to develop and produce in quantity high frequency cables. Radar was becoming more important.

Q. And that work on putting a sheathing around a polyethylene cable came, I assume, following the decision that polyethylene was the most logical insulation for such cables? A. Yes, I would say so.

Q. And so, following a decision to use polyethylene as the insulation rather than perhaps polystyrene or cyclicized rubber, then a campaign was put on to put a proper sheathing around the polyethylene to give it what, wear resistance and oil resistance and heat resistance, and some of those qualities? A. Well, as the name implies, a protective sheath, a flexible sheath which would give some degree of protection to the underlying polyethylene, the vinyls to give some measure of oil protection, for instance.

Q. Oil protection, protection against wear? A. Could be, yes.

Q. Protection against heat too? A. To a certain extent.

Q. Now, the work of General Electric, with respect to that specific project of putting a sheathing around polyethylene, commenced around the beginning of the year 1944, is that the way I understand it? The witness is referring again to Defendants' Exhibit 55, to refresh his recollection. A. Well, this would seem to indicate it, yes.

Q. Now, if you had been confronted with the same problem in 1935, would you have known how to go about it then? A. 1935?

Q. Yes. A. Well, in the first place, in 1935 we had no—.

Q. Let's say 1935 or 1936, if that makes it easier. A. There were no resins available, such as polyethylene.

Q. Well now, I am asking you to postulate that polyethylene was available in 1935 and 1936, if it were, and you were asked to put a sheathing around it in 1935 or 1936. A. We didn't have the polyvinyl chloride in 1935, 1936.

Q. Oh, I think that Carbine and Carbon were producing it in substantial commercial quantities in 1932, and earlier. You were using it on your Flamenol insulation in 1936.

• • • • • • • • • • •

Q. I will withdraw the last question, and start over again. In your work with these coaxial cables, did you find that some materials, next to the polyethylene, would deteriorate much more than others? A. Well, we and everyone else who was vitally concerned with the business of making high frequency cables found that vinyl jackets of various types would, to use an expression which

I used some time ago, would poison, there would be
36 migration of the plasticizer into the polyethylene,
and therefore then tend to destroy the electrical excellence of the polyethylene itself.

Q. Now, if a plasticizer were about as good in its electrical properties as the polyethylene, then its presence in the polyethylene wouldn't have an effect on the electrical characteristics of the polyethylene, would it? A. In other words, you are asking me to say that a plasticizer, which of itself is good electrically, would not poison or harm the polyethylene, right.

Q. That is approximately my question. A. Yes, I think that is a statement of fact.

Q. So that in a particular instance, if you found no poisoning, then one of two things would be so: Either there was no migration into the polyethylene, or else whatever did migrate into the polyethylene was about as good electrically as the polyethylene itself? A. I would assume that that would be the situation. If you had no deleterious effect, then the electrical values of your plasticizer in question would be satisfactory.

Q. So the mere fact that you had no drop-off in electrical properties of the polyethylene insulation wouldn't do anything more than tell you that one or the other of the two things must be so, namely, either you had no substantial migration into the polyethylene, or else whatever did migrate in was about as good electrically as the poly-
37 ethylene? A. I would say that would be a statement of fact.

* * * * * * * * * *

39 Q. Was that really it at all? Weren't you interested in a sheathing that wouldn't hurt the electrical

properties of the polyethylene? You really knew nothing about its migration, did you? A. You can quickly get yourself into difficulties when you are dealing with new materials. You can find whether you get migration or you don't get migration, and what happens to the material electrically.

Q. What happens to the material electrically when you mix G-25 with polyethylene? A. I don't know. I never tried it.

• • • • • • • • • • •

48 Q. My question is not directed to possibilities. My question is simply directed to this: You do not know whether, say, five or ten percent Paraplex G-25 in the polyethylene insulation would hurt it in any way or not, do you? A. I would expect that a material like that would do—I don't know what would be gained.

Q. But the fact is, sir, that you don't know, isn't that right? A. I don't know, of my own knowledge, no.

• • • • • • • • • • •

Depositions taken by Defendants in Saint Paul, Minnesota, commencing January 31, 1955

Excerpts from deposition of **Esther Eastwold LePage**:

Direct Examination

6 Q. Were you ever employed by the plaintiff herein? A. Yes, I was.

Q. And when did you first become so employed? A. It was the last part of June or the first part of July, 1943.

• • • • • • • • • • •

Q. Prior to that, what was your formal education? A. I had just graduated from the University of Minnesota and

obtained a Bachelor of Arts degree, with a major in chemistry and a minor in biochemistry.

• • • • • • • • • • •

7 Q. You worked until the spring of '51,—at Minnesota Mining and Manufacturing Company? A. Yes.

• • • • • • • • • • •

19 Mr. Kirkpatrick: For present purposes, at least, Mrs. LePage, I am going to speak of such copolymers by simply calling them vinyl polymers, meaning those high in chloride and low in acetate, or even straight chloride, ...

• • • • • • • • • • •

Mr. Kirkpatrick: I realize that the term may include more than those two, but will ordinarily include those two.

The Witness: Yes.

Mr. Holmes: Will include at least those two.

The Witness: That's right.

• • • • • • • • • • •

34 Q. Did you yourself apply coatings to polymerized vinyl backings? A. What kind of coatings?

Q. Any kind of coatings. I'm asking you if you applied coatings? A. Yes.

Q. What sort of coatings? A. Some were adhesive coatings.

• • • • • • • • • • •

37 Q. Did you have, at the time you started the project, any information as to any attempts that may have been made by the 3-M people with respect to that general subject matter? A. It was my understanding that many people had tried to make a tape that would serve

these end uses of an electrical tape that was stretchable and retractable and remained pressure-sensitive, but there had been no success in the field.

• • • • • • • • • • •

42 Q. In your use of those monomeric plasticizers to form backings, did you apply pressure-sensitive adhesive compositions thereto? A. I did on some of them.

Q. And for the time being, I'm referring to the use solely of monomeric plasticizers, such as DOP and tricresyl phosphate. Did you subject such tapes to any aging tests? A. Yes, I did.

Q. With what results? A. The adhesive would get pasty and useless.

• • • • • • • • • • •

44 A. We were trying to make a stretchable retractable tape that would be good for electrical uses, and
45 that's all we were trying to do.

• • • • • • • • • • •

A. I again say we were trying to make this stretchable retractable tape that would have good adhesive properties. We couldn't make a desirable one with the monomeric plasticizers alone.

Q. Did you think the G-25 plasticizer would avoid the pasty adhesive difficulty that you had and that you have mentioned in the use of the monomeric plasticizers alone? A. At that time I wasn't in a position to think anything. I was just trying to make a tape that would be stretchable and retractable, and we were trying many things to do that.

Q. What was your understanding at the time you used the monomeric plasticizers as to the reason for the
46 adhesive going pasty on aging?

• • • • • • • • • • •

A. Well, it's hard to say what I felt at the time, but we felt that the plasticizer migrated into the adhesive,—plasticizer meaning DOP or monomeric plasticizer.

* * * * * * * * * *

47 Q. Once you started on it, Mrs. LePage, was your work confined to the plastic insulating tape investigation for a matter of some time,—continuing along for a matter of some time? A. Yes, I think so.

Q. And for how long a time, approximately? A. It was more than a year.

* * * * * * * * * *

67 Q. Mrs. LePage, were you the only one, so far as you know, who mixed up these formulations and made small batches of dough and roll tapes? I am speaking of experimental quantities for Dr. Lundquist on this investigation. A. Well, I was the only one working directly for Dr. Lundquist.

Q. In that work? A. In that work, but I'm sure there were others in the company doing perhaps a similar study.

Q. On plastic tapes? A. There was a very great desire to have a tape like that, so that I don't think that the work was all limited to Dr. Lundquist and I.

Q. Well, do you know, for example, whether either Oace or Snell made formulations and made tape therefrom? A. I think they did.

Q. Did they have equipment in their own lab for such work? A. We used equipment in common.

Q. Pardon? A. We used equipment in common.

82 Q. How much aging did tape made with DOP plasticizer only withstand before becoming pasty, as referred to in that first paragraph, in your experience? A. Well, that's—I can't say exactly.

Q. All right, pick 30, pick 40, pick 50. I am just giving you some amount. A. But the pastiness would appear in a very short while. I think under two weeks.

140 Q. Did you sign a reissue application at that meeting you have referred to in the hospital? A. Yes.

Q. This really isn't material, but I have some interest in why you were confined to the hospital. Was that in connection with your youngster? A. No, I had been very ill with a strep infection.

154 A. I am becoming concerned with the question before this.

155 ("Question: Can an adhesive pressure-sensitive insulated tape with vinyl polymer film backing, having the properties described in your patent, be made with satisfactory results using only a viscous, non-mi-
156 grating plasticizer resin, or resins?") A. I think you could get a plasticizing system of non-migrating materials which would be useful.

Excerpts from deposition of

Robert B. Snell:

Direct Examination

167 A. My name is Robert Burn Snell, and I reside at 544 Wildwood Avenue, in the Village of Birchwood, at White Bear Lake, Minnesota. I am employed at the present time by the Minnesota Mining & Manufacturing Company.

Q. And have been since —. A. And have been since July 1944. I would like to back up one minute there. My position today is not the same as it was in July of 1944. I'm technically employed today as a product engineer, and came to the Minnesota Mining Company in 1944 as a laboratory technician.

. . . . . .

168 A. I studied some chemistry at the University of Minnesota and some other technical subjects, and was taken into the Army in May of 1942 and sent to the Midland Radio and Television School at Kansas City, Missouri, where I graduated. From there I was sent to a War Department school at Hobe Sound, Florida, where I was trained in a War Department radar school on United States radar units. Let me say this: My qualifications for being hired at the Minnesota Mining & Manufacturing Company were my early training at the University of Minnesota and my technical war training.

Q. Are you one of the applicants and patentees in this Dace, et al. Reissue Patent No. 23,843? A. Yes, I am —

. . . . . .

Were you asked to bring here with you the earliest papers you could find relating to plastic electric insulating

tapes involving a vinyl polymer backing, pressure-sensitive adhesive coating, and so forth? A. Yes, I think that's correct.

169 Q. And is it also correct that this sheet dated February 21, 1944, SL-8874, was the earliest of such sheets you could find? A. Well, they have had experimental work running on at the Minnesota Mining Company as early as 1935, I believe, on plastic backings, and I didn't search for any of that material and I wouldn't know where to look for it but I know there is information on it. Many people worked on it before I was ever hired by the company.

Q. But so far as your own personal relation, it began in the early summer of 1944? A. That is correct.

* * * * * * * * * * *

170 Mr. Kinney: I think that the record should show that as far as some of this earlier work is concerned, I have already showed you a copy of SL-4324, signed by H. J. Tierney, back in the year 1938.

Mr. Kirkpatrick: That is true, — what was regarded or called the other day as the Westbee and Tierney early work books.

Mr. Kinney: Hurd and Tierney.

Mr. Kirkpatrick: Yes, Hurd and Tierney.

Mr. Kinney: Now, that was an attempt to make a tape by coating a pressure-sensitive adhesive on a vinyl chloride backing, but an unsuccessful attempt.

Mr. Kirkpatrick: And with a monomeric plasticizer.

Mr. Kinney: I believe so.

Q. (By Mr. Kirkpatrick) Mr. Snell, I call your attention to another document, bearing the designation SL-9556, dated October 9, 1944. Are you the Robert B. Snell whose name appears therein with the typewritten signature
171 at the bottom? A. That correct.

• • • • • • • • • • •

182 The Witness: Yes, the tape I showed to the attorneys prior to the filing of the application for the patent, Patent No. 2,559,990, was a tape with substantially the same properties as the tape I'm holding in my hand. It had about 150 per cent elongation in the backing. It was composed of a vinyl copolymer, a vinyl chloride and vinyl acetate, with a plasticizer material, and a stabilizer, and a primer, and a pressure-sensitive adhesive coating on the inner side, — coated on the inner side of the film. The backing was in excellent equilibrium with the adhesive. By that I mean that upon aging the tape retained its tack, as we refer to it in the trade, or its adhesion, and did not go tack-free upon aging.

• • • • • • • • • • •

Excerpts from deposition of

Ralph J. Oace:

Direct Examination

199 Q. You are the Ralph J. Oace, are you not, who is one of the patentees of the Reissue Patent No. 23,843? A. Yes.

Q. Now, Mr. Oace, how long have you been with 3-M? A. Since January, 1937.

Q. And what was your education? A. Bachelor of Chemical Engineering.

Q. And you came right from school to 3-M? A. That's right.

Q. In what division were you first employed? A. In the Tape Laboratory.

Q. And you continued in that Tape Laboratory for some time thereafter? A. Yes.

Q. How long? A. Until the fall of 1945.

Q. Now, it has appeared that early in 1944 a project was undertaken to develop a pressure-sensitive adhesive tape with plasticized vinyl film backing in which the adhesive would not be affected by the plasticizer in the backing and that you and Mr. Snell and Mrs. LePage were associated as a team, so to speak, in working on this project. Is that substantially correct?

• • • • • • • • • • •

200 A. Well, it all depends on how you describe "team". It was between departments, you see. There was no formal team formed. There was a close association.

Q. Well, there was a close association. And you were brought into it along with Mrs. LePage, is that correct, and Mr. Snell, — at least as soon as he became associated with it?

201 A. Yes. There was some mention in the middle there someplace about adhesive — working with the backing. There were innumerable problems in the construction of that.

Q. Oh, yes, but I'm reading from a report — A. (Interposing) The project was designed to devise a splicing tape.

Q. And at least one of the problems was to develop one

in which the adhesive would not be affected by the plasticizer? A. Yes.

Q. Now, was Mr. Snell a subordinate of yours? A. Yes.

Q. Now, Mrs. LePage has testified and her notes show that she made vinyl film, plasticized it — various formulas — and tested it. What part did you play in the development, along with Mr. Snell and Mrs. LePage? What function did you perform, so to speak? A. Well, I was directing Bob Snell's work and coordinating with the Research Department by way of Esther Eastwold.

Q. What was the nature of Mr. Snell's work under you, — his part of it? A. It was pretty complex. What phase did you want explained?

Q. Well, I don't know what he did, so I don't know what phase to mention. A. He did laboratory work on this particular project.

202 Q. Did he make films and plasticize them? A Yes.

Q. And tested them? A. Using other facilities in the laboratory.

Q. Much the way Mrs. LePage did, is that true? A. Yes.

Q. And would he report to you? A. Yes.

Q. What sort of reports were compiled or made and handed in to your superior, who I presume was Dr. Lundquist, is that correct? A. No, no — that was Esther Eastwold's superior.

Q. Well, to whom were your reports made? A. To Mr. Tierney.

• • • • • • • • • •

208 ("Question: Now, do you find in this patent any suggestion that the use of some liquid plasticizer in the mix is or may be optional? Do you find any suggestion in the patent of that?") A. I think I would have to read this whole patent through in order to be sure to answer that properly.

• • • • • • • • • • •

Q. (By Mr. Holmes) Well, let's read it.

210 Q. (By Mr. Holmes) Well, I think you had better read the patent, Mr. Oace. A. All right.

(A brief recess was taken in order to allow the witness time to read the patent.)

A. I didn't read it all the way through, but I picked out a few points I think will answer the question.

Q. Yes. A. You will have to remember that this is not a legal answer to this question. It is a laboratory man's answer to the question and consequently it may be

211 a poor interpretation. But in Column 5, in lines 21 to 26, it says: "Ethyl acrylate polymer has been found useful, as previously noted; this modifier has somewhat less tendency to cause tack loss than does the 'Paraplex G-25,' hence may be used in even greater amounts in many formulations."

Well now, I think to a laboratory man that would be a suggestion that the liquid plasticizer may be eliminated.

• • • • • • • • • • •

213 Q. Well, did you sometime learn or were you informed that in making a tape having the characteristics defined in your patent, a pressure-sensitive adhesive tape with vinyl film backing, some non-migrating resinous plasticizer alone could be used without loss of tack? A. Well, I cited from the specification that in the original

application that there was some indication that a
214 liquid plasticizer would be optional, so that that would indicate that I already knew the answer to that question.

• • • • • • • • • • •

Excerpts from deposition of
Dr. William E. Lundquist:

Direct Examination

218 Yes, sir. An earlier affidavit by you in this case states that you received a Ph.D. in chemistry at the University of Illinois in the year 1938. What did you do thereafter? A. When I finished at the University of Illinois in 1938, I went to work for the DuPont Company at the Experimental Station in Wilmington as a chemist for four years approximately, and then in the spring
219 of 1942 I came to work for Minnesota Mining.

• • • • • • • • • • •

221 Q. What was the different work you spoke of as to the Tape Laboratory? A. In 1945 I transferred from Central Research to the Tape Laboratory.

Q. Can you place approximately when in 1945?
222 A. The summer.

Q. Did you continue after your transfer to keep in touch with her as to this work — any contact with her? A. Yes.

• • • • • • • • • • •

232 Q. Is it correct to say that G-25, G-40, G-50, and G-53 are all resinous modifiers within the meaning of that phrase which appears at Column 3, line 57, of the reissue patent which I hand you?

• • • • • • • • • • •

A. I would have to say that's one of those yes or no questions. I wouldn't be able to answer it with either yes or no, because it wouldn't be true.

233

Q. (By Mr. Kirkpatrick) Deal with them one at a time then.

• • • • • • • • • • •

A. From one viewpoint they are all polymeric plasticizers but they do not do what it says here in this sentence. This sentence that you referred to reads as follows: "Instead, it has been shown that pressure-sensitive adhesives in prolonged contact with highly stretchable and elastic films consisting solely of vinyl polymer and resinous modifier lose a great deal, if not all, of their initial tackiness or pressure-sensitivity." And certainly with G-50, and G-53 this does not happen. With the G-25, as we purchase it today, this does not happen. With the G-25 as we purchased it in 1944 and '45, it did happen.

• • • • • • • • • • •

236

Q. (By Mr. Kirkpatrick) Referring again to page 12 of your affidavit, Doctor, and again at line 8 thereof, I believe you said that you at least saw or supervised the making of that test with respect to G-53, or G-50? A. Yes.

• • • • • • • • • • •

Q. Do you think that that test there referred to was made for the purposes of the preparation of this affidavit? A. No.

• • • • • • • • • • •

238

Q. In the commercial practice so far as you know of 3-M in the manufacture of the tape of this invention, has it always used a combination of two plasticizers,

—one a viscous, non-migrating resinous plasticizer, and the other a plasticizer of the order of DOP, or the like? A. No.

Q. As I understand it, the first experimental production was with G-25 and such plasticizer as DOP, is that correct? A. I believe that's correct.

• • • • • • • • • • •

250 A. I stated yesterday, I believe, that the G-25 that we originally purchased from Rohm & Haas caused loss of adhesion of the adhesive after tape had been made using G-25 as the sole plasticizer. The G-25 that we purchase from them today has not caused this tack loss and I don't believe I made any comment about G-40.

Q. Do you say that there has been a change in the material G-25 as received at the outset and as received today? A. Yes.

• • • • • • • • • • •

252 A. Yes; and the two things that we know is that on the early batches when we used the G-25 as the sole plasticizer and made finished rolls of tape, we had loss of adhesion of the adhesive, and we do not get this today.

Q. Was that loss of adhesive also true in 1945? A. I believe so.

Q. In 1946? A. I would not be able to say the precise date or period of time when there was a change, because we weren't necessarily looking for it on each batch as the batches were received.

• • • • • • • • • • •

EXCERPTS FROM PLAINTIFF'S EXHIBITS

Excerpts from Plaintiff's Exhibit 2—File History of the original Oace et al Patent No. 2,559,990

Excerpt from Patent Office Action of May 11, 1948

33 Claims 3, 4 and 6-9 are rejected as functional . . . .

• • • • • • • • • • •

Excerpts from Applicants' Amendment filed Nov. 8, 1948

36 As previously indicated, the present claims take the place of claims 3-9 . . .

The new claims overcome the rejection on the ground of functionality . . .

• • • • • • • • • • •

37 In thus re-defining the invention to overcome the functionality rejection, . . . applicants do not of course waive whatever inherent rights they are entitled to in respect to the doctrine of equivalency as applied by the federal courts in infringement suits in determining whether or not the defendant is liable as an infringer of the invention.

• • • • • • • • • • •

THE REFERENCES DO NOT SUGGEST THE CLAIMED INVENTION

39 To properly reject claims to a novel article upon a combination of references, it is hornbook law that the primary reference must disclose a similar article and the secondary reference must suggest the idea of modifying the article of the primary reference so as to result in the claimed article, and this must be evident to persons of ordinary skill in the art without exercise of inventive faculties and without the benefit of the hindsight wisdom

acquired after the claimed article has been disclosed to them by others.

It is also hornbook law that a novel combination resulting in a new article of great value to the art, which fills a need not previously met, is not unpatentable merely because the ingredients are individually old."

Excerpts from Patent Office Action of May 24, 1950

56 Claims 10 and 12 are also further rejected as functional . . .

* * * * * * * * * *

57 It appears that the present application contains patentable subject matter, . . .

Excerpts from Plaintiff's Exhibit 4—File History and Contents of Oace et al Reissue Patent in Suit, Re. No. 23,843

Excerpts from Applicants' Amendment dated January 6, 1953

34 Suppose one attempted to evade the Oace et al Patent No. 2,559,990 by replacing the two plasticizers for the backing, specified in the original patent claims, by a single plasticizer which could combine the function and effect of the two named plasticizers. Would this avoid infringement?

* * * * * * * * * *

36 . . . "it is obvious" that the functions of the two plasticizers could be combined into one (by appropriate application of the knowledge of chemistry) in duplicating applicants' novel electrical insulating tape.

Thus it is submitted that the new claims as a whole are

not much, if any, broader in scope than the claims of the original patent, *when the doctrine of equivalents is properly applied* in determining what will infringe the latter claims. Of course, it always helps in a patent suit to have the matter of range of equivalency argued out in the Patent Office, where possible, so that the claims are *in terms* covering the devices or structures charged as an infringement. That is one purpose of this reissue application.

Excerpt from Patent Office Action of January 22, 1953

55 Responsive to amendment filed January 8, 1953.

1.The denial of the reissue of patent No. 2,559,990 on the ground of estoppel is believed to be proper, and is repeated for the reasons as fully set forth in the Office letter of August 7, 1952, paragraphs 1 and 2.

* * * * * * * * * * *

Excerpts from Affidavit of Dr. William E. Lundquist of May 8, 1953

73 . . . They (the applicants) were concerned with replacing ordinary rubber electricians' tape and friction tape in the insulation of electrical splices. . . . they felt it necessary to tackle the problem basically and apparently visualized that the difficulty in the prior art was that the other people, to the extent that they may have been concerned with the problem, were doing like Schmidt, namely, trying to coat an adhesive on some kind of a conventional
74 vinyl film backing. . . . the plasticizer would migrate from the film and "poison" the adhesive . . .

* * * * * * * * * * *

75 In accordance with the teaching of Oace et al (for example, see the Oace et al specification, page 5,

line 23 et seq.) instead of using 2 parts of "Paraplex G-25" (high molecular weight plasticizer) to 1 part of dioctyl phthalate (liquid plasticizer), where the "Paraplex G-25" is replaced by a somewhat lower molecular weight plasticizer, the amount of liquid plasticizer may be correspondingly reduced or modified, with equivalent results. For example, where, instead of "Paraplex G-25", "Paraplex G-53" or "Paraplex G-50" are used to plasticize the vinyl polymer (Vinylite VYNW), the dioctyl phthalate or equivalent may be reduced or eliminated, with equivalent results. Tape has been made under affiant's directions, using "Paraplex G-50" in one instance and "Paraplex G-53" in another instance, and affiant demonstrated, to his own satisfaction, that the proportion of the dioctyl phthalate or equivalent may be modified as suggested by Oace et al, and can be reduced to zero in such event, with equivalent results.

With every change in the ingredients of the plasticizer material, e. g., with increases or decreases in molecular weight of the more viscous plasticizer ingredient, the proportions of the more liquid plasticizer must be varied accordingly and, as above indicated, under certain circumstances reduced to zero, or eliminated.

* * * * * * * * * *

CONCLUSION

77-78 I can see nothing in the disclosure of the Groff patent which discloses the article described and claimed in any of the claims of the above-identified Oace et al application. I can find nothing in the Kitchin et al patent which discloses the article described in the above-identified Oace et al application and claimed in any of the claims against which this patent is applied, namely, claims 6, 7, 8, 13 and 14. I can see no reasonable basis on

which the disclosures of Schmidt or Groff could be combined with the disclosures of Eustis et al or Mitchell so as to anticipate what is taught in the Oace et al specification and claimed in the claims thereof. In my view, the pressure-sensitive vinyl plastic electrical tape described and claimed by Oace et al was a pioneer contribution to the adhesive tape art, and is not taught or suggested by the antecedent art.

Affidavit of T. W. Sharp, of April 17, 1953, manager of the Sheet and Foil Division, Industrial Products Department, of the Bakelite Company, a Division of Union Carbide and Carbon Corporation.

79-80 T. W. SHARP, being duly sworn according to law, deposes and says that he is, and since January 1, 1945 has been, employed by the Bakelite Company, a Division of Union Carbide and Carbon Corporation. Prior to his employment by Union Carbide and Carbon Corporation, he graduated from Harvard University with the degree of Bachelor of Arts in Chemistry.

Bakelite Company has long been a manufacturer of various types of vinyl films, and they have been sold in sheet form and, to some extent, in tape form. Affiant is advised and believes that on or about December 6, 1945 Mr. H. J. Tierney, of Minnesota Mining and Manufacturing Company, called at the office of the Bakelite Company and had a discussion with Mr. H. K. Intemann, and others, relative to whether the Bakelite Company would manufacture for said Minnesota Mining and Manufacturing Company a special type of vinyl plastic film backing to be used in the commercial production of pressure-sensitive vinyl plastic electrical tape, and the Bakelite Company agreed

to make limited quantities of such film for Minnesota Mining and Manufacturing Company and to its specifications. Prior to that time, to the best of Affiant's knowledge and belief, no one other than Minnesota Mining and Manufacturing Company had ever placed on the market, or made, a pressure-sensitive vinyl plastic electrical tape. The usual type of electrical insulation then employed for splices was rubber electricians' tape, over which was wound friction tape.

On or about March 18, 1946, Dr. W. E. Lundquist, of Minnesota Mining and Manufacturing Company, wrote to the Bakelite Company, a Division of Union Carbide and Carbon Corporation, to the attention of Mr. T. R. Orme, and therein disclosed the specific formulation of the vinyl film desired by Minnesota Mining and Manufacturing Company for the manufacture of the pressure-sensitive vinyl plastic electrical tape and ordered a quantity of said film for commercial production of said tape. On or about June 7, 1946, in response to a follow-up letter from Dr. Lundquist, inquiring as to why the special vinyl film ordered had not been shipped, Mr. T. R. Orme wrote to Dr. Lundquist, stating that "the formulation was supplied by you", i.e., by Dr. Lundquist of Minnesota Mining and Manufacturing Company, and further stating that previous to receiving this formulation, the Bakelite Company "had had no experience in running a compound of this type in production". Accordingly, the film made by the Bakelite Company in the year 1946, in accordance with the directions of Minnesota Mining and Manufacturing Company, was of a type different from any film on which the Bakelite Company had had previous experience in production; and the pressure-sensitive vinyl plastic electrical tape made by Minnesota Mining and Manufacturing Company there-

from was, to the best of Affiant's knowledge and belief, a new commercial product. The first shipment of such film by the Bakelite Company to Minnesota Mining and Manufacturing Company was made, in small quantity, in or about September, 1946. On or about November 5, 1946, Minnesota Mining and Manufacturing Company ordered 2,000 pounds of such film, and subsequently ordered larger quantities, which orders were filled by the Bakelite Company. Film of that type was supplied by the Bakelite Company to Minnesota Mining and Manufacturing Company for the purpose of making pressure-sensitive vinyl plastic electrical tape.

Further Affiant saith not.

/s/ T. W. SHARP
T. W. SHARP

Affidavit of May 5, 1953, of Robert H. Breither, an engineer, of Lion Manufacturing Corporation, Chicago Ill.

85 ROBERT BREITHER, being duly sworn according to law, deposes and says:

That he is an engineer employed by Lion Manufacturing Corporation, 2640 Belmont Avenue, Chicago, Illinois, and has been employed by said corporation and its parent company for about twenty-two years. During World War II, the Lion Manufacturing Corporation, among other things, manufactured component parts and control units used in chin turrets, and these units contained harness assemblies which Lion Manufacturing Corporation wrappep with an ordinary vinyl film and sealed with cyclohexanone, a solvent for the vinyl film. This procedure was extremely messy in production and caused considerable

trouble. It left up to the assembler the decision as to how much cyclohexanone to apply. In some cases too much of it was applied, causing the vinyl film to tear and dissolve. Nonetheless, it was the best system for insulating joints on such units then available. Thereafter this method of insulting harness assemblies was replaced by the use of "SCOTCH" Brand Electrical Tape, a pressure-sensitive vinyl plastic electrical tape. Samples of such a product were first brought to the attention of Lion Manufacturing Corporation by representatives of Minnesota Mining & Manufacturing Company in the year 1945 and, due to its uniqueness and great advantages, was immediately adopted by Lion Manufacturing Corporation, and has been used by Lion Manufacturing Corporation in increasing quantities in subsequent years. In affiant's opinion, pressure-sensitive vinyl plastic electrical tape was a highly important contribution to the electrical industry.

/s/ ROBERT H. BREITHER
ROBERT BREITHER

Excerpts from Applicants' Brief on Appeal, dated October 22, 1953

THE REJECTION

143 The rejection, as stated in the final action (Paper No. 4), was that:

(1) The reissue should be denied on the ground of estoppel, because some claims (narrower in some particulars than certain of the claims of this reissue application) were cancelled during the prosecution of the original application.

* * * * * * * * * * *

145 The unsoundness of the estoppel rejection was pointed out fully in Amendment dated June 15, 1953,

at pages 10 to 14 thereof. If the Examiner did not intend to drop it in Office action dated July 20, 1953, it should be dropped, as clearly inapplicable to the facts of this case.

• • • • • • • • • •

169 The examiner referred to the cancellation of original claims 1-3 in the original patent application as a basis for the estoppel rejection herein. It is a well-established principle that one cannot present, in a reissue application, the identical claim cancelled from an original application, and the Examiner argues that this principle should be extended so that one could not cover in a reissue application some or all of the territory covered by a cancelled claim of the original application, . . .

• • • • • • • • • •

. . . Claim 3 was cancelled primarily because of arguments about the specificity of the definition of certain elements of the claim, and not because of any anticipatory prior art.

Excerpts from Reply Brief of Applicants
Filed October 22, 1953

197-198 Claim 3 of Serial No. 641,000 is directed to an adhesive tape article, and it was replaced by the claims of the original patent, which are claims 1 to 5 of this reissue application. It will be noted that there are very significant differences in terms between that cancelled claim 3 and claim 16 of the present application, for example, which stands allowed, subject to applicants' right to a reissue. Claim 16 is in some respects broader and in other respects narrower in defining the "plasticizing material" for the vinyl polymer. Claim 16 is definitely more

specific than said cancelled claim 3 in reciting that the film backing has a thickness of 4 to 20 mils. There is an obvious difference in scope between the definition of the adhesive layer or coating in claim 16 and in the cancelled claim 3. There are other obvious differences between claim 16 and said cancelled claim 3. To paraphrase the wording of the Court of Appeals for the Ninth Circuit in *National Nut Co. v. Sontag Chain Stores,* 107 F. (2d) 318, "claims of the scope of claim 16 and the other claims here on appeal were never in, and cancelled from, the original application" (see original brief, page 41).

To paraphrase the Court of Appeals, Fourth Circuit, in *Florence-Mayo Nuway Co. v. Hardy,* 168 F. 2d 778, 783 (end of col. 2): "Claim 16 (and others) of this reissue application points out, as cancelled claim 3 did not do, what is the heart of the invention claimed."

• • • • • • • • • • •

202 Applicants are not here asserting any claim which is the same or substantially the same as any claim cancelled from their original application. . . . Accordingly, the rejection on estoppel is not supported. . . .

Excerpts from Decision of the Board of Appeals, dated January 25, 1954

209 . . . Since claims 1, 2, 4, 5 and 16 are of substantially the same scope as were claims 1 to 5, inclusive, allowed in the original patent, we do not see how any estoppel can arise against such claims . . .

• • • • • • • • • • •

215 The decision of the Examiner . . . is reversed with respect to claims 1, 2, 4, 5 and 16.

Excerpts from Applicants' Request for Reconsideration by the Board of Appeals, filed February 23, 1954

217-218 At page 6 of the decision it is stated that claim 17" does not, in our opinion, materially differ from claim 3 of the earlier application". Claim 17 is copied in the Board's decision (pages 2 and 3). Likewise, claim 3 of the earlier application, as well as the rejection thereof, is copied into the Board's decision (at page 5 thereof).

One significant difference is in the description or definition of the film-forming vinyl polymer.

Claim 17 calls for "a film-forming polymer of monomer material including at least a *major* proportion of vinyl chloride". Claim 3 of the original application, on the other hand, did not contain such provision; and in respect thereto, in the rejection of said claim, the Examiner ruled:

> "The term 'vinyl chloride polymer' is too broad since it includes all polymerized resins which may include *some vinyl* chloride."

(See page 5 of the Board's decision herein of January 25, 1954.)

Thus claim 17 differs from said claim 3 of the original application in an important respect, so as to avoid a ground of rejection leveled against said claim 3.

It will be seen that claim 17 is like allowed claim 16 in this and most other respects; and not like said cancelled claim 3.

As another illustration of a significant difference, claim 3 of the original application failed to limit the proportion

of the plasticizer to the polymer, whereas appeal claim 17 does recite such proportion. Claim 17 has both a lower and upper limit on the proportion of plasticizer to film-forming vinyl polymer, in this respect also being similar to allowed claim 16. It provides that the plasticizer for the vinyl polymer is present "in an amount within the range of at least about 1/3 the weight of said polymer but in a substantially lesser amount than said polymer". On the other hand, claim 3 recites no lower percentage limit on the proportion of plasticizer; and, further, does not really recite an upper percentage limit of the entire plasticizer.

Claim 17 also contains other differences over cancelled claim 3 of the original application, e.g., that the backing is much thicker than ordinary cellophane tape backings, a "thickness of about 4 to 20 mils" being specified. Again, claim 17 is like allowed claims 1 and 16 in this respect and different from said cancelled claim 3.

The primary difference between claim 17 and allowed claim 16 is that claim 17 does not recite a primer coating. A primer coating is desirable but not essential. This has been recognized throughout, as shown by claim 1 of the original patent, which, likewise, does not recite a primer. The difference of claim 17 over allowed claim 16 parallels the difference of allowed claim 1 over allowed claim 4. One recites a primer coating; the other does not.

Significant differences between appeal claim 17 and cancelled claim 3 of the original application therefore exist, as just pointed out above. So this is not a case where applicants are attempting to recapture "claims in substantially their original form". But even this has been recognized as proper where "the applicant was induced by the Patent Office to narrow his claims" unnecessarily, whereupon "the

Patent Office . . . (thus) contributed to the mistake": see the decision of Judge Pine in *Kinnear v. Marzall*, 95 F. Supp. 55, at 58 (January, 1951), which cites and relies upon *Morey* v. *Lockwood*, 8 Wall. 230, 75 U. S. 230, 19 L. Ed. 339. However, appellants do not need to invoke these principles, as claim 17 differs materially in terms and scope from cancelled claim 3 of the original application.

• • • • • • • • • • • •

219 To such extent as cancelled claim 3 resembles appeal claim 17, it still more closely resembles claims 1 to 5 (which were claims of the original patent). Hence such subject matter was never given up; and, accordingly, there can be no estoppel in respect thereto.

Excerpts from Decision of the Board of Appeals on Reconsideration, dated March 18, 1954

222-223 Claim 17 was refused for two distinct reasons, first, as without patentable merit over the Schmidt patent and, second, by reason of estoppel arising from the rejection of claim 3 in the earlier application and its subsequent withdrawal. With respect to the rejection on estoppel, petitioners now direct attention to particular differences between claim 3 of the former case and claim 17.

• • • • • • • • • • • •

224 We have reviewed our decision in connection with the contentions presented in the petition and have come to the conclusion that the rejection of claim 17 should not be sustained.

• • • • • • • • • • • •

Our decision is altered to the extent that the rejection of claim 17 is reversed, . . .

• • • • • • • • • • • •

Excerpts from Applicants' Supplemental Oath, dated June 22, 1954

243-244 Deponents failed adequately to explain to their attorneys, during the prosecution of their original application, the nature and characteristics of the materials described in the specification, and the relationship of the characteristics of such materials to each other, from which the actual scope of the invention may be determined, and the importance of the details thereof. Each and all of the deponents were virtually without any prior experience in connection with patents at the time of their original application. As a result of conferences and discussions had within one month prior to the filing of their above identified reissue application, Serial No. 298,013, on July 9, 1952, it became apparent to the deponents that their invention was not sufficiently or adequately claimed, within the scope of the disclosures of their specification and of the inherent qualities of the illustrative embodiments of their invention as disclosed therein, and that the claims of their original patent, except by the application of the doctrine of equivalents, were not sufficient adequately to cover their invention. In particular, it became apparent that deponents themselves, upon a reading of the specification, could readily suggest how to evade the terms of each of the claims of their original patent, while making the product defined in their said original patent.

• • • • • • • • • •

Excerpts from Plaintiff's Exhibit 5—Consolidated Requests for Admissions, directed to defendants, Sears Roebuck and Plymouth Rubber, and their Responses. (All requests not specifically denied are admitted, per statement of defendants' counsel, as well as per Rule 36 of Rules of Civil Procedure.) Requests 1 to 60 inclusive and 69, and Responses.

1. As far back as about 1928 Plymouth Rubber Company, Inc., was making and selling friction tape. (605)*
(No answer)

2. Friction tape consists of strips of cotton sheeting impregnated with an adhesive insulating compound based on rubber or bitumen. (P. 5, Px-117, "Kabelitems")*
(No answer)

3. As far back as about 1928 Plymouth Rubber Company, Inc. was making and selling a rubber insulation tape. (605 and 606)
(No answer)

4. Rubber insulating tape is rubber compounds calendered to a normal thickness of about 0.030 inch. (5, PX-17)
(No answer)

5. At least as early as 1928, Plymouth Rubber Company, Inc. was making and selling cable tape. (654)
(No answer)

6. Cable tapes are dry and non-tacky. (85, 688)
(No answer)

---

* References are to pages of depositions taken here in Boston, February 1955, or to exhibit numbers.

7. Cable tape is used by cable manufacturers to wind spirally around electrical cables. (85)
(No answer)

8. At least as early as 1947 or 1948, and before Plymouth commenced its pressure-sensitive vinyl plastic tape project, Plymouth Rubber Company, Inc. began producing and selling a non-adhesive plastic harness tape, made from a vinyl sheeting, plasticized to make it stretchable. (692)
(No answer)

9. The Plymouth Rubber Company, Inc. had made and sold vinyl chloride plastic raincoats, vinyl chloride plastic baby pants, and other sheeted vinyl plastic material for roughly ten years prior to February, 1955. (9)
(No answer)

10. Plymouth Plastic Electrical Tape was developed for Plymouth Rubber Company, Inc. by Morris M. Danovitch, chief chemist of the tape and cable division of said company. (14 and 16)
(No answer)

11. Said Danovitch first worked with vinyl resins around 1942 or 1943. (14 and 16)
(No answer)

12. From his previous experience, in the year 1948 said Danovitch was already familiar with plasticizers and vinyl resins. (9 and 14)
(No answer)

13. Said Danovitch first became familiar with the fact that "SCOTCH" Brand Electrical Tape, No. 33, was on the market "sometime around the latter part of '47". (20)
(No answer)

14. When said Danovitch started his work to make Plymouth Plastic Electrical Tape, "We had some 'SCOTCH' tape to guide us. Just to look at. You could buy it in any store." (24)

Answer: As to item 14, defendant denies the quotation. The witness Danovitch said: "We had some 'Scotch' tape but not to guide us. Just to look at. You could buy it in any store."

15. Said Danovitch read "ads in the papers" in or about the year 1948 on "SCOTCH" Brand No. 33 Electrical Tape. (78)

(No answer)

16. Before said Danovitch started his work to make Plymouth Plastic Electrical Tape in 1948 he had examined a pamphlet entitled "Kabelitems", No. 25, date April, 1948, published and distributed by Bakelite Corporation, a unit of Union Carbide and Carbon Corporation. (Said pamphlet was marked for identification as Plaintiff's Exhibit 17 in the depositions taken herein in Boston in February, 1955.) (256)

(No answer)

17. The pamphlet referred to in the foregoing request discloses the physical and electrical properties of the pressure-sensitive, stretchable and retractable vinyl plastic insulating tape sold commercially as "SCOTCH" Brand Electrical Tape, and the application and use thereof.

Answer: As to item 17, defendant admits only if in line 2 the words "some of" are inserted before "the physical and electrical properties."

18. Said Danovitch knew in 1948 that "SCOTCH" Brand

No. 33 Electrical Tape was made with a polyvinyl chloride backing. (254 and 255)
(No answer)

19. Said Danovitch knew in 1948 that the polyvinyl backing of "SCOTCH" Brand No. 33 Electrical Tape contained plasticizer material. (255)
(No answer)

20. Said Danovitch compared Plymouth Plastic Electrical Tape he was developing with the "SCOTCH" Brand No. 33 Electrical Tape of commerce as to tensile strength and elongation. (74)
(No answer)

21. Said Danovitch was told by Frank Harris, Vice President of said Plymouth Rubber Company, to produce "an adhesive plastic tape." (629)
(No answer)

22. Said Harris said to said Danovitch in 1948, "Make me a roll of plastic tape." (631)
(No answer)

23. Frank Harris, Vice President of Plymouth Rubber Company, Inc., first knew of pressure-sensitive, stretchable vinyl plastic electrical tape around 1947. (617)
(No answer)

24. Said Frank Harris knew by April, 1948, that Minnesota Mining & Manufacturing Company was making pressure-sensitive, stretchable and retractable vinyl plastic insulating tape. (617, 619-20)
(No answer)

25. Said Danovitch started his work to make Plymouth Plastic Electrical Tape in 1948. (12, 631, 667)
(No answer)

26. Said work was commenced at least as early as August or September, 1948. (50)
(No answer)

27. On or about May 16, 1950, sample rolls of Plymouth Plastic Electrical Tape were submitted to Underwriters Laboratories for a certificate of approval. (695, DX-30)
(No answer)

28. Plymouth Plastic Electrical Tape was approved by Underwriters Laboratories on or about October 20, 1950. (20)
(No answer)

29. Plymouth Plastic Electrical Tape was first sold late in the year 1950. (25)
(No answer)

30. By February, 1955, the sale of Plymouth Plastic Electrical Tape was several times higher in proportion to the sales of rubber and friction tape than it was in 1951. (143)
Answer: As to item 30, defendant denies that this request accurately states the substance of the testimony referred to. Defendant admits that by February, 1955, the percentage of sales of Plymouth Plastic Electrical Tape in relation to its sales of rubber and friction tape was several times more in percentage than it was in 1951.

31. In his experiental work said Danovitch made samples using as the plasticizing material for the vinyl polymer:

(a) PARAPLEX G-25 (88, 89)
(No answer)

(b) PARAPLEX G-40 (88, 89)
(No answer)

(c) Dioctyl phthalate (sometimes referred to as DOP) (33)

Answer: As to item 31 (c), defendant denies use by Danovitch of Dioctyl phthalate (DOP) except "a small amount" in laboratory experiment and in one experimental factory run five parts of DOP mixed with 74 parts of G-40.

(d) Mixtures of PARAPLEX G-25 and DOP (32 and 88)

Answer: As to item 31(d) defendant denies use by Danovitch in experimental work of mixtures of G-25 and DOP except mixtures of G-25 and "a very small minute part" of DOP in laboratory experiment.

(e) Tricresyl phosphate (33)

Answer: As to item 31(e) defendant denies use by Danovitch in experimental work of Tricresyl phosphate except "in one case a small amount of Tricresyl phosphate" in laboratory experiment.

(f) PARAPLEX G-60 (33)

Answer: As to item 31(f), defendant denies use by Danovitch of G-60, except "a small amount of G-60" in laboratory experiment.

(g) "Quite a few" combinations of polyester and liquid components. (34)

Answer: As to item 31(g) defendant admits that Danovitch used "quite a few" combinations of polyester and liquid components in laboratory experiment.

(Each lettered item requires a separate response.)

32. In his experimental work to make Plymouth Plastic Electrical Tape for Plymouth in 1948-49, Danovitch "didn't have a very good success with G-25 at that time." (743)
(No answer)

33. In the development of Plymouth Plastic Electrical

Tape, 53 or 54 "factory formulations, including factory experimental runs" were made. (371)
(No answer)

34. A much greater number (than 53 or 54) of laboratory formulations were tried by Danovitch in the development of Plymouth Plastic Electrical Tape. (371)
Answer: As to item 34, defendant denies that Danovich tried a much greater number (than 53 or 54) of laboratory formulations but admits that in addition to the 53 or 54 factory formulations and factory experimental runs there were many laboratory experimental formulations, making the total number of factory and laboratory formulations greater than the figure 53 or 54 because some were mixed in the laboratory only.

35. After production and sale of Plymouth Plastic Electrical Tape began, there was trouble with pinholes, telescoping of rolls, appearance, waste and seconds. (678)
(No answer)

36. These troubles were corrected somtime in 1952. (678)
(No answer)

37. Except that some equipment in the factory of Plymouth Rubber Company, Inc., "We had to modify for the plastic tape, as by change of knife settings and adjustments", the said Plymouth Company used the same mixing, milling, calendering and coating equipment for Plymouth Plastic Electrical Tape that it had used and continued to use in producing such vinyl sheet products as baby pants, raincoats and shower curtain material. (85-87)
(No answer)

38. The same equipment was and is used in mixing the ingredients for Plymouth Plastic Electrical Tape as had

previously been used for mixing the ingredients for baby pants or shower curtain material. (87)

(No answer)

39. The same equipment on which vinyl plastic sheeting was calendered for shower curtains and baby pants was and is used to calender the vinyl plastic sheeting for the backing member of Plymouth Plastic Electrical Tape. (87)

(No answer)

40. The same equipment was and is used for coating the adhesive on the backing member of Plymouth Plastic Electrical Tape that was used earlier to coat adhesive on cloth, with some adjustments. (87-88)

(No answer)

41. PARAPLEX G-25 was first announced by Rohm & Haas or its predecessor, Resinous Products Company, in 1943.

Answer: As to item 41, defendant admits that Paraplex G-25 was first announced by Rohm & Haas or its predecessor, Resinous Products Company, in November, 1943.

42. In his experimental work to make Plymouth Plastic Electrical Tape, said Danovitch knew that Rohm & Haas represented that its PARAPLEX G-40 and PARAPLEX G-25 each is a plasticizer which is resistant to migration. (311 and 312)

Answer: As to item 42, defendant admits that Danovitch knew that Rohm & Haas represented that its Paraplex G-40 and Paraplex G-25 each is a "non-migrating" plasticizer.

43. PARAPLEX G-40 is of lower average molecular weight than PARAPLEX G-25.

(No answer)

44. In his experimental work said Danovitch "got the same results using the straight (PARAPLEX) G-40" as he did using PARAPLEX G-25 and dioctyl phthalate. (89)
Answer: As to item 44, defendant denies. Defendant admits that in his experimental work said Danovitch "got the same results using straight (Paraplex) G-40" as he did using Paraplex G-25 and Dioctyl phthalate from the standpoint of good dispersal only.

45. It would require approximately 3 to 4 parts of PARAPLEX G-25 to one part of dioctyl phthalate to get a plasticizer material having an average molecular weight equal of that of PARAPLEX G-40. (308)

Answer: Defendant denies the truth of the matter set forth in item 45.

46. In his development work of Plymouth Plastic Electrical Tape, said Danovitch was interested in results and not in molecular weights or mixtures. (309 and 310).
Answer: (No answer)

47. Prior to the advent of pressure-sensitive, vinyl plastic electrical tape, the accepted standard of a good insulation splice was the use of rubber electrician's tape overwound with friction tape. (22-23)
Answer: (No answer)

48. Plymouth Rubber Company, Inc., has "used as a sales argument that plastic electrical tape if properly used is cheaper for the electrician than the combination of friction and rubber tape". (193)
Answer: (No answer)

49. The Plymouth Rubber Company, Inc., is responsible for the publication and distrtibution of the advertising

material identified in the record as Plaintiff's Exhibit 11. (276, 280)

Answer: (No answer)

50. The advertisement of Plymouth Rubber Company, Inc., appearing in "Contractor's Electrical Equipment", in issues thereof of February, April, June, August, October and December of 1951, representing that Plymouth Plastic Electrical Tape is

"Protective	Economical
Durable	Practical
Versatile	Convenient
Safe	Tough"

is substantially true. (PX-11)

Answer: (No answer)

51. The representations in an advertisement proofed December, 1952, by the printer to Plymouth Rubber Company, Inc., that Plymouth Plastic Electrical Tape is:

"RECOMMENDED IN PLACE OF FRICTION AND RUBBER TAPES IN THE FOLLOWING SITUATIONS:

1. Where tape is subject to abrasion (resists abrasion).
2. Where space is limited (makes neater job, as in terminal box).
3. Where tape is subject to water, acids, alkalies, corrosion (resists all).
4. Where time must be saved (does the job much more quickly)."

are substantially true. (PX-11)

Answer: (No answer)

52. Plymouth Rubber Company, Inc., is responsible for the publication and distribution of the envelope stuffer marked Plaintiff's Exhibit 7 for identification. (299, 189)

Answer: (No answer)

53. The physical, electrical and chemical properties stated in Plaintiff's Exhibit 7, for identification, for Plymouth Plastic Electrical Tape No. 7 and No. 10 are substantially correct.

Answer: (No answer)

54. Plymouth Rubber Company, Inc., has represented to the public that its Plymouth Plastic Electrical Tape is:

"Sunlight	Not affected
Corrosive effect on electrical conductors	None
Resistance to water	Excellent
Resistance to acids	Excellent
Resistance to alkalies	Excellent
Resistance to oils	Excellent
Resistance to aging at room temperatures	Excellent"

(PX-6, 7)

Answer: (No answer)

55. In the production of Plymouth Plastic Electrical Tape sold by Plymouth Rubber Company, Inc., other than to the United States or an agency thereof, the plasticizer for the vinyl plastic backing material from first production in 1950 to August 3, 1954, was principally PARAPLEX G-40.

Answer: As to item 55, defendant denies the accuracy of the statement of this request. Defendant admits that in th production of Plymouth Electrical Tape sold by Plymouh Rubber Company, Inc., other than to the United States or an agency thereof, and except for some tape sold

to Sears, Roebuck & Company, Paraplex G-40 was the sole plasticizer for the vinyl plastic backing material from the first production in 1950 to August 3, 1954.

56. In May of 1954, to meet government specifications, in plastic tape made for the United States, Plymouth Rubber Company, Inc., used PARAPLEX G-25 as the principal ingredient of the plasticizing material for the backing member of this Plymouth Plastic Electrical Tape. (378-9)

Answer: As to item 56, defendant admits only if the statement is amended by substituting for the word "principal" in line 3, the word "sole".

57. In a deposition taken herein on February 16, 1955, Frank Harris, a vice president of Plymouth Rubber Company, Inc., was asked the following questions and gave the following answers:

"Q451 You, of course, are now familiar with the Minnesota Mining & Manufacturing tape known as the 'Scotch' electrical tape No. 33?

A. I don't know anything about that number, no.

Q452 Well, does it represent a tape that you visualized that you would get out of this work of Mr. Danovitch?

A. Oh, yes." (662)

Answer: (No answer)

58. "SCOTCH" Brand Electrical Tape, No. 33 and 22, and Plymouth Plastic Electrical Tape, of generally similar gauges, respectively, have substantially the same

(1) physical properties,

(2) chemical properties,

(3) electrical properties. (201-2)

Answer: (No answer)

59. The backing material of Plymouth Plastic Electrical Tape is a copolymer of vinyl chloride and vinyl acetate, containing plasticizing material. (291)

Answer: (No answer)

60. Plymouth Plastic Electrical Tape is (or includes)

(a) Pressure-sensitive (297)

(b) Stretchable (297)

(c) Retractable (297)

(d) Insulating (297)

(e) Water-resistant (298)

(f) Hydrocarbon oil insoluble (299)

(g) High dielectric strength (300)

(h) Film backing 4-20 mils thick (301)

(i) Backing a copolymer of vinyl chloride and vinyl acetate with vinyl chloride the predominating constituant (302)

(j) Backing a homogeneous mixture of plasticizing material and vinyl copolymers (302)

(k) Nonvolatile plasticizing material (302)

(l) Plasticizing material present within the range of at least about one-third of the weight of vinyl copolymer (30)

(m) Plasticizer material never present in as great a quantity as the vinyl copoolymer (303)

(n) Plasticizing material normally not present in greater quantity than one-half of the weight of the vinyl copolymer (303)

(o) Plasticizing material for the backing comprises PARAPLEX G-40 (304)

Answer: As to item 60 (o), defendant can neither admit nor deny because it does not know the sense in which the word "comprises" is used—whether in the sense of "consists" or of "includes". Defendant admits that as to one Plymouth product the plasticizing material for the backing consists of Paralplex G-40 only and as to its other product of Paraplex G-25 only.

(p) Backing material stretchy, elastic and retractable (315)

(q) Tape can be wound up in a roll upon itself and later unwound without delamination of the tape or offsetting of the adhesives (315)

(r) An adhesive primer coating (315)

(s) An adhesive primer coating adapted to increase the anchorage of the pressume-sensitive adhesive coating to the plasticized vinyl backing (315)

(t) Pressure-sensitive adhesive coating applied over primer coating (315)

(u) Adhesive coating water-insoluable (316)

(v) Adhesive coating normally tacky (316)

(w) Adhesive coating of a rubber-resin type (316)

(x) Adhesive coating relatively thin compared with the thickness of the film backing (316))

(y) Backing in equilibrium to adhesive coating (317-323)

Answer: As to item 60(y), defendant cannot admit or deny because it is not known in what sense the word "equilibrium" is used. Defendant admits that the Plymouth Plastic Electric Tape comprises a plasticized vinyl film and an adhesive coating wherein the coating does not become pasty or lose its tack when the tape is stored at ordinary room temperature for some weeks or months.

(z) No substantial migration of plasticizer from backing into adhesive (322)

(aa) No delamination of the tape (323)

(bb) No offsetting of the adhesive (323)

(cc) Stretchable in widths of an inch or less by hand pulling to at least 50% at room temperature (323)

(dd) Will stretch 100% (324)

(ee) If stretched 30% of its original length will retract "approximately" to its original length (324)

(ff) Readily conformable to irregular surfaces in insulating and splicing (324)

(gg) Will make a snug, tight splice (325)

(hh) Sufficiently aggressive adhesive to stay tightly and snugly wrapped about a splice (327)

Each lettered item is to be responded to separately.

Answer: (No answer except to items (o) and (y) as noted.)

* * * * * * * * * *

69. Sears, Roebuck & Company sells, and since prior to August 3, 1954, has sold, pressure-sensitive, stretchable and retractable, vinyl plastic electrical tape manufactured and packaged for it by Plymouth Rubber Company, Inc., under the brand name "HOMART".

Answer: (No answer)

Excerpts from Plaintiff's Exhibit B-17, Danovitch Deposition

"Kabelitems"

Bakelite Company—1948

Time-honored materials in the electrician's kit are friction tape and rubber insulating tape. . . . As a legacy from the days when rubber was the universal dielectric for building wire, rubber insulating and friction tapes continue on as splice insulating materials for vinyl plastic coated wire. This interim practice may well be discontinued when the merits of VINYLITE plastic backed electrical tapes are generally recognized.

EXCERPTS FROM DEFENDANTS' EXHIBITS

Patented May 29, 1951 2,554,791

Defendants' Exhibit 67 — Nickerson Patent

No. 2,554,791

UNITED STATES PATENT OFFICE

2,554,791

PRESSURE ADHESIVE TAPE AND SHEET

Mortimer H. Nickerson, Springfield, Mass., assignor, by mesne assignments, to Donald B. Alexander, Henry T. Chamberlain, John F. Mannion, Walter A. Wade, Edgar R. Bourke, Ernest W. Schneider, and Charles S. Vrtis, as trustees of The Arthur J. Schmitt Foundation, Lemont, Ill., a charitable trust

No Drawing. Application November 20, 1948, Serial No. 61,299

9 Claims. (Cl. 117—122)

1

This invention relates to an improved adhesive sheet, more particularly to sheets in tape form which may be prepared and sold in the form of rolls, one face of the tape being provided with a coating of pressure sensitive adhesive.

Tapes of this kind are commonly made of sheets, or strips of fabric, paper or regenerated cellulose, coated with a tacky composition of latex or reclaimed rubber with a gum or resin.

One of the difficulties encountered in the manufacture of such tapes is the tendency of the adhesive coating to peel or "offset" from the tape backing material when the tape is wound in roll form. This tendency results from various causes arising from the character of the backing strip, the adhesive used, and the nature of the plasticizers and solvents used in preparing the various elements of the tape and adhesive, and the relative adhesive and cohesive characteristics of the adhesive material.

One object of the present invention is to provide a pressure adhesive tape having improved toughness and electrical insulating characteristics, and possessing adhesive and non-offsetting properties adequate for the difficult conditions under which such a tape is used.

Other and further objects will be apparent from the following specification and claims.

coating of pressure sensitive adhesive.

Tapes of this kind are commonly made of sheets, or strips of fabric, paper or regenerated cellulose, coated with a tacky composition of latex or reclaimed rubber with a gum or resin.

One of the difficulties encountered in the manufacture of such tapes is the tendency of the adhesive coating to peel or "offset" from the tape backing material when the tape is wound in roll form. This tendency results from various causes arising from the character of the backing strip, the adhesive used, and the nature of the plasticizers and solvents used in preparing the various elements of the tape and adhesive, and the relative adhesive and cohesive characteristics of the adhesive material.

One object of the present invention is to provide a pressure adhesive tape having improved toughness and electrical insulating characteristics, and possessing adhesive and non-offsetting properties adequate for the difficult conditions under which such a tape is used.

Other and further objects will be apparent from the following specification and claims.

I have found that a plasticized polyvinyl chloride sheeting possesses the strength and elastic qualities needed for my purposes as a backing material particularly and preferably when properly stretch oriented. A satisfactory degree and character of orientation is provided by heating and stretching the sheet or film and holding it until cool. The degree of elongation imparted to the sheet may be 100% or higher.

The adhesive material may be a conventional water dispersion of reclaimed rubber, 30% solids, with or without some natural rubber, which is available under various trade names.

The use of a plasticized polyvinyl chloride backing involves certain problems such as the tendency to migration of the plasticizers present in the backing or used in connection with the adhesive materials. These and other problems arising from the use of the polyvinyl chloride backing are overcome by the specific materials and formulating steps shortly to be pointed out.

Polyvinyl chloride is most commonly plasticized with ester type plasticizers. By their chemical nature good plasticizers have good solvent action and compatibility with a wide variety of resinous materials. Since these plasticizers are generally liquids, they also possess mobility even when dissolved in or compounded with a suitable resin. This mobility accounts for the observed tendency of plasticizer to migrate from one solid phase to another where both phases are compatible with the plasticizer and are in close contact. In this case it was observed that the common liquid ester type plasticizers were compatible not only with the polyvinyl chloride backing sheet but also with the rubber composition used as the pressure-sensitive adhesive layer. Migration of the plasticizer into the adhesive layer caused an observable softening and loss of cohesiveness with a consequent weakening of the adhesive bond. The same would be true with copolymers of vinyl chloride and vinyl acetate, polyvinyl butyral, or cellulose acetate and similar materials.

A very necessary function of the adhesive layer in any so-called strippable tape is that while it must stick firmly and well to any surface on which it is pressed it must stick even more firmly to its own backing layer, in this case plasticized polyvinyl chloride. It was found that if an aqueous dispersion of reclaimed rubber were applied directly to a polyvinyl chloride sheet and dried thereon that the adhesion to the plasticized polyvinyl chloride was no greater than the adhesion to other surfaces on which the tape might be pressed. As a result, stripping of the tape resulted in offset, i. e., transfer of some of the adhesive layer from the plasticized polyvinyl chloride backing to the surface on which the tape had been pressed.

I have found that the two effects described in the above paragraphs can be eliminated by first prime-coating the polyvinyl chloride with polybutene B–100. This material, polybutene B–100, is a polymer of isobutylene having an average molecular weight of about 100,000. The average molecular weight for my purposes may vary between 60,000 (B–60) and 120,000 (B–120) but the B–100 is preferable and commercially available. It is most conveniently applied as a 10% solution in toluene or equivalent hydrocarbon solvent and may be applied by spraying or in any other suitable manner. This primer coating provides a surface to which the reclaimed rubber has a natural adhesion and also provides a barrier to the migration of the ester plasticizer into the adhesive layer. The primer coating may of course contain other materials than polyisobutylene and the latter will continue to exert its effect generally in proportion to the percentage in which it is present.

The polybutene primer coating is allowed to dry and a coating of the reclaimed rubber dispersion

is then applied. For best results two coats of the reclaimed rubber dispersion are applied, the first coat being allowed to dry before the second is applied.

After drying of the second adhesive coat the sheets, usually slit into tapes of various widths, may be rolled up on themselves to a convenient size for handling. The result of the above combinations of materials and processes is a strong flexible tape ready for instant use on unwinding from its roll and adhering strongly to dry surfaces.

Polyvinyl chloride may be suitably plasticized by mechanically blending it with an equal weight of a copolymer of butadiene and acrylonitrile. The acrylonitrile content of the copolymer may vary between 18–35%. Polyvinyl chloride plasticized in this way has certain advantages because of the resinous character of the plasticizer which effectively reduces any tendency towards migration. This backing is prime coated as above described. After drying of the primer coat an adhesive coating is applied which comprises a 25% solution of equal parts by weight of polybutene B–100 polybutene B–12 and an ester of a hydrogenated rosin acid, the latter increasing the cohesiveness. Polybutene B–12 is a polymer of isobutylene having an average molecular weight of about 12,000. A satisfactory rosin acid ester is commercially available as "Staybelite Ester 10." The addition of the B–12 gives increased adhesive qualities over the B–100 alone and the normally expected decrease in cohesiveness is obviated by the addition of the rosin acid ester. These materials are dissolved in an aromatic solvent such as toluene with a boiling point of about 111° C., or a combination of aromatic and aliphatic solvents in which the polybutenes are soluble and which are commonly available under various trade names, "Rubberso:" being an example.

In the last described combination the primer coat serves to bond the pressure sensitive adhesive coat and the backing sheet. Since the plasticizers in both the backing sheet and the adhesive coating are in this case resinous there is no tendency toward migration.

This last described combination has the advantage that the butadiene-acrylonitrile copolymer is exceptionally oil resistant and this resistance is retained in the polyvinyl chloride. The result is a strong tough pressure sensitive tape with excellent electrical properties and a superior resistance to oils and chemicals.

What I claim is:

1. A pressure sensitive adhesive tape comprising a backing strip of plasticized polyvinyl chloride, said strip being coated on one side with a polymer of isobutylene having an average molecular weight of not substantially less than 60,000 and not substantially greater than 120,000, and having a coating of pressure sensitive adhesive superposed on said first-named coating, said adhesive comprising mainly a water dispersion of reclaimed rubber, 30% solids, the first-named coating providing a non-offsetting bond between the backing strip and the adhesive coating and preventing the migration of migratory plasticizers from the backing into the adhesive.

2. A pressure sensitive adhesive tape comprising a backing strip of plasticized stretch oriented polyvinyl chloride, said strip being coated on one side with a polymer of isobutylene having an average molecular weight of not substantially less than 60,000 and not substantially greater than 120,000, and having a coating of pressure sensitive adhesive superposed on said first-named coating, said adhesive comprising mainly a water dispersion of reclaimed rubber, 30% solids, the first-named coating providing a non-offsetting bond between the backing strip and the adhesive coating and preventing the migration of migratory plasticizers from the backing into the adhesive.

3. A pressure sensitive adhesive tape comprising a backing strip of plasticized, polyvinyl chloride, said strip being coated on one side with a solution of a polymer of isobutylene having an average molecular weight of approximately 100,000 in an aromatic solvent, and having a coating of a rubber-type pressure sensitive adhesive superposed on said first-named coating, said adhesive comprising mainly a water dispersion of reclaimed rubber, 30% solids, the first-named coating providing a non-offsetting bond between the backing strip and the adhesive coating and preventing the migration of migratory plasticizers from the backing into the adhesive.

4. A pressure sensitive adhesive tape comprising a backing strip of stretch oriented, plasticized polyvinyl chloride, said strip being coated on one side with a solution of a polymer of isobutylene having an average molecular weight of approximately 100,000 in an aromatic solvent, and having a coating of a rubber-type pressure sensitive adhesive superposed on said first-named coating, said adhesive comprising mainly a water dispersion of reclaimed rubber, 30% solids, the first-named coating providing a non-offsetting bond between the backing strip and the adhesive coating and preventing the migration of migratory plasticizers from the backing into the adhesive.

5. A pressure sensitive adhesive tape comprising a backing strip of stretch oriented ester plasticized polyvinyl chloride, said strip being coated on one side with a solution of a polymer of isobutylene having an average molecular weight of approximately 100,000 in an aromatic solvent, and having a coating of a rubber-type pressure sensitive adhesive superposed on said first-named coating, said adhesive comprising mainly a water dispersion of reclaimed rubber, 30% solids, the first-named coating providing a non-offsetting bond between the backing strip and the adhesive coating and preventing the migration of migratory plasticizers from the backing into the adhesive.

6. A pressure sensitive adhesive tape comprising a backing strip of polyvinyl chloride plasticized with a copolymer of butadiene and acrylonitrile provided on one side with a coating consisting of a solution of a polymer of isobutylene having an average molecular weight of approximately 100,000 and having a coating of pressure sensitive adhesive superposed on said first-named coating, the latter providing a non-offsetting bond between the adhesive and the backing strip, said pressure sensitive adhesive comprising substantially equal parts of a polymer of isobutylene having an average molecular weight of approximately 100,000, a polymer of isobutylene having an average molecular weight of approximately 12,000 and an ester of hydrogenated rosin acid.

7. A pressure sensitive adhesive tape comprising a backing strip of stretch oriented polyvinyl

Excerpts from Plaintiff's Exhibit 19—Chart illustrating plaintiff's analysis of claims in issue, verbatim. Claims 1 & 6.

Claim 1.

A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprised of:

I. A stretchable and elastic film backing having
  (1) a thickness of 4 to 20 mils and
  (2) formed of a homogeneous mixture primarily consisting of a stable blend of
    (a) a film-forming polymer of monomers including at least a major proportion of vinyl chloride,
    (b' a substantially non-volatile liquid phthalyl
    (ester plasticizer amounting to 8 to 20 parts
    (per 100 parts of said polymer, and
    (b" a soft and viscous low-acid-number alkyd
    (plasticizer resin in amount at least equal to
    (the amount of said liquid phthalyl ester
    (plasticizer,
      (y) the total amount of said plasticizers being about 1/3 to ½ the amount of said polymer and
    (c) the proportions being such that the adhesive tape has the properties of stretch and elasticity hereafter specified without causing pastiness or tack-loss of the contacting adhesive in the roll; and

II. A cucohesive normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing;

1. said adhesive tape unwindable without delamination or offsetting of adhesive,
2. being originally stretchable by hand-pulling to an extent of at least 50% at room temperature and
3. being substantially completely retractable from an elongation of 30% as herein specified.

Claim 6

pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprising:

I. A water-insoluble and hydrocarbon-oil-insoluble film backing of high dielectric strength.
   (1) Containing a stabilizer and
   (2) having a thickness of 4 to 20 mils and
   (3) formed of a homogeneous mixture primarily consisting of a stable blend of
      (a) a film-forming polymer of monomers including at least a major proportion of vinyl chloride, and
      (b) a substantially non-volatile plasticizing material therefor in an amount within the range of at least 1/3 the weight of said polymer but in a substantially lesser amount than said polymer and comprising
         (x) at least a major proportion of a non-migrating viscous plasticizer resin, and
      (c) the proportions being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contacting adhesive in the roll;

II. An adhesive primer coating on the inner face of the film backing adapted to increase the anchorage of adhesive coating; and

III. A water-insoluble normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing, over said primer coating, said adhesive coating being thin in relation to said film backing;
   (1) said film backing being in permanent equilibrium with said pressure-sensitive adhesive coating so as to avoid pastiness or loss of tack of the said adhesive coating and diminution of the flexibility of said film backing;

said adhesive tape being unwindable from the roll without delamination of the tape or offsetting of the adhesive,

being originally stretchable in widths not greater than about one inch by simple hand pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and

being substantially completely retractable from an elongation of 30%, as herein specified;

said tape being readily conformable to irregular surfaces in insulating wire splices and

its elasticity, retractability and high adhesion value making it easy, in insulated splices, to produce snug wrappings and coverings, and

said tape having sufficiently aggressive adhesiveness to remain tightly and snugly wrapped around splices and wires.

Plaintiff's Exhibit T-15

(Handwritten)

Paraplex G-25 Resin 90129
Sample obtained from supply in tape Lab.
Manufactured by Resinous Products Company.

Resin hydrolyzed with alcoholic KOH & determinations run on solution.

The Resin was made from sebacic acid, a glycol—probably propylene glycol,—, and a small amount of an oil. A phosphorus catalyst was probably used. There was no sulfur, nitrogen, chlorine, or castor oil present.
Reported 9-19-44
AR-186

R. W. PERLICH

Witness:
W. E. LUNDQUIST
12-17-45

Plaintiff's Exhibit T-15A

ANALYTICAL TEST REPORT
TAPE DEPARTMENT

AR-186 Sept. 19, 1944

SUBJECT: Paraplex G-25 Resin

REPORT:

A sample of Paraplex G-25 Resin manufactured by the Resinous Products Company was obtained from a supply in the Tape Laboratory. This resin is being used as a non-bleeding plasticizer for Vinylite Resins.

The resin was made from sebacic acid and a glycol, probably propylene glycol. There was a small amount of phosphorus present, probably from the catalyst. There was also

a small amount of an unidentified oil present. There was no sulfur, nitrogen, chlorine, or castor oil present.

Paraplex G-25 was thought to be made under one of the following patents obtained by Mr. H. A. Bruson, assignor to the Resinous Products & Chemical Company: 1,783,166; 1,783,167; 1,783,168. These patents involve the use of a polyhydric alcohol having three or more hydroxy groups and a dibasic acid having from six to ten carbon atoms. The alcohols would include such compounds as glycerol and mannitol; the acids include adipic, pimelic, suberic, azelaic, and sebacic acids. The use of a trihydric alcohol would produce an ester having side chains. A representative of the Resinous Products Company made the statement that Paraplex G-25 had no side chains and this would indicate the use of a dihydric glycol. Chemical tests indicate that this glycol could be propylene glycol which would fit in with the above conditions.

In Patent No. 1,783,167, an oil was introduced into the resin formed with glycerol and sebacic acid to produce a more flexible resin. The oils used included castor oil, linseed oil and other drying oils. Dihydric glycols were also added to produce a tack in the final resin. The drying oils produced a non-tacky resin.

It is my opinion that Paraplex G-25 was not made under the above mentioned patents inasmuch as those patents were based on a poly hydric alcohol having three or more hydroxy groups. Paraplex G-25 is probably made from a dihydroxy alcohol. The oil present in this resin probably brings it under the scope of Patent No. 1,783,167.
Reference: Notebook 901, page 29.

/s/ R. W. PERLICH
R. W. PERLICH

RWP:mc

Plaintiff's Exhibit T-16

TAPE LABORATORY FILE COPY

CC-Messrs.
R. F. Christensen
E. W. Kellgren
P. L. Hedrick
W. O. Olson
D. M. Scott
H. J. Tierney

March 18, 1946

Mr. T. R. Orme
Bakelite Corporation
230 North Michigan Avenue
Chicago 1, Illinois

Dear Mr. Orme:

During your recent visit with Messrs. Sharp and Hallis you indicated that your company would be willing to calendar special films for us. We now wish to take advantage of your offer.

We would like to get about 500 pounds of .006" calendered film in 24" width having the following composition.

70 parts VYNW
20 parts Paraplex G-25
10 parts Dioctyl Phthalate
2 parts Calcium Stearate (or the proper amount of any other stabilizer you prefer)

This film will be quite easily stretched so we ask that you make an effort to give it to us in an unstretched condition.

Could you give us an indication of the price on this film at this time?

Yours very truly,

MINNESOTA MINING & MANUFACTURING COMPANY

W. E. LUNDQUIST
Director
Research and Development
TAPE DIVISION

WEL:vk
Mr. T. W. Sharp.

Plaintiff's Holton Exhibit 12

Minnesota Mining
v. Sears Roebuck
C. A. 878-G October 26, 1955

SALES AND ADVERTISING EXPENSE, 1945 to 1953; inclusive, on "SCOTCH" Brand pressure-sensitive, stretchable and retractable vinyl plastic tape.

	Net Sales in United States After credits for returns (in dollars)	Advertising Expenses (in dollars)	Advertising Expense % of Sales
1945	8,270.19		
1946	94,578.23		
1947	610,317.86	6,022.23	1.0
1948	1,487,018.69	31,786.73	2.1
1949	2,361,946.10	56,494.81	2.4
1950	3,927,975.85	68,702.76	1.7
1951	5,868,071.09	109,247.20	1.9
1952	7,433,933.38	108,637.29	1.5
1953	8,712,744.75	118,826.74	1.4

R. V. Holton

Plaintiff's Holton Exhibit 13-B

GENERAL ELECTRIC
SUPPLY CORPORATION

Wabash 5454

845 South Clinton St.
Chicago 7, Ill.
August 25, 1947.

SUBJECT: #33 SCOTCH ELECTRICAL TAPE.

Gentlemen:

For the first time in fifty years a revoluntionary electrical Tape is on the market ready for immediate delivery.

This new tape answers the purpose of Friction and Rubber Tapes—all you have to use is the #33 SCOTCH ELECTRICAL TAPE and one roll does the work of one roll of friction and two rolls of rubber tape. A tremendous time saver and a big improvement in many other ways.

The attached brochure describes the electrical characteristics of #33 SCOTCH ELECTRICAL TAPE, also shows some everyday applications. Read this carefully.

We have already disposed of over 10,000 rolls of this tape in Chicago. The following prices are in effect:

12 Roll Lots	$1.25 per roll
48 Roll Lots	1.20 per roll
140 Roll Lots	1.11 per roll
576 Roll Lots	1.05 per roll
1152 Roll Lots	.99 per roll

If you haven't tried #33 SCOTCH ELECTRICAL TAPE send us an order for twelve rolls. If you have tried it and want more, just fill in the order form below, mail it in and we will make immediate shipment.

Very truly yours,
/s/ A. J. Lutz
A. J. Lutz
Manager Supply Sales Division

GENERAL ELECTRIC SUPPLY CORPORATION,
845 SO. CLINTON STREET,
CHICAGO, ILLINOIS

PLEASE SHIP____ROLLS #33 SCOTCH ELECTRICAL TAPE.

Name_____

Date_____ Address_____

Shalita Exhibit 3-E (New York Depositions)

TECHNICAL TAPE CORPORATION

TO: All Salesmen
FROM: Marc L. Lawson
SUBJECT: Direct Mail Promotion — Vinelectric Tape

Attached please find specimen copy of a forceful promotional mailing piece now being received by all potential vinyl electric tape users throughout the United States. When reply cards are received from users they will be turned over to each of you for follow up and for placement through distribution.

We shall like your prompt attention to these leads so that we may fill all orders promptly.
You will be notified of other mailings as soon as they are ready for release.

Vinelectric Plastic Tape is the most important contribution made in the electrical field in 30 years — Let's get our share of new business.

M. L. Lawson /s/ Marc L. Lawson
11/21/51

chloride plasticized with a copolymer of butadiene and acrylonitrile provided on one side with a coating consisting of a solution of a polymer of isobutylene having an average molecular weight of approximately 100,000 and having a coating of pressure sensitive adhesive superposed on said first-named coating, the latter providing a non-offsetting bond between the adhesive and the backing strip, said pressure sensitive adhesive comprising substantially equal parts of a polymer of isobutylene having an average molecular weight of approximately 100,000, a polymer of isobutylene having an average molecular weight of approximately 12,000 and an ester of hydrogenated rosin acid.

8. A pressure sensitive adhesive tape comprising a backing strip of polyvinyl chloride plasticized with a copolymer of butadiene and acrylonitrile, the acrylonitrile content of the copolymer comprising from 18% to 35% thereof, said backing strip being coated on one side with a toluene solution of a polymer of isobutylene having an average molecular weight of approximately 100,000, and having a coating of pressure sensitive adhesive superposed on said first-named coating, the latter providing a non-offsetting bond between the adhesive and the backing strip, said pressure sensitive adhesive comprising substantially equal parts of a polymer of isobutylene having an average molecular weight of approximately 100,000 and a polymer of isobutylene having an average molecular weight of approximately 12,000.

9. A pressure sensitive adhesive tape comprising a backing strip of stretch oriented polyvinyl chloride plasticized with a copolymer of butadiene and acrylonitrile, the acrylonitrile content of the copolymer comprising from 18% to 35% thereof, said backing strip being coated on one side with a toluene solution of a polymer of isobutylene having an average molecular weight of approximately 100,000, and having a coating of pressure sensitive adhesive superposed on said first-named coating, the latter providing a non-offsetting bond between the adhesive and the backing strip, said pressure sensitive adhesive comprising substantially equal parts of a polymer of isobutylene having an average molecular weight of approximately 100,000, a polymer of isobutylene having an average molecular weight of approximately 12,000, and an ester of a rosin acid dissolved in an aromatic solvent.

MORTIMER H. NICKERSON.

REFERENCES CITED

The following references are of record in the file of this patent.

UNITED STATES PATENTS

Number	Name	Date
2,319,959	Tierney	May 25, 1943
2,332,265	Schmidt	Oct. 19, 1943
2,439,481	Martin	Apr. 13, 1948
2,442,279	Alderfer	May 25, 1948

Excerpts from Defendants' Exhibit 68

(Letterhead of)
FISH, RICHARDSON & NEAVE
Boston 9
August 23, 1950

Mr. Morris M. Danovitch
Plymouth Rubber Company, Inc.
104 Revere Street
Canton, Massachusetts

Dear Mr. Danovitch:

In accordance with your request when you were here on August 4th, we have obtained copies of the following patents owned by Minnesota Mining & Manufacturing Company and have examined them in connection with your proposed new polyvinyl electrical tape. The patents are as follows:

Kellgren	2,410,079
Drew	2,410,053
Drew	2,236,567
Carpenter	2,030,135
Drew	2,177,627
Drew	2,156,380
Drew	2,328,066
Drew	1,954,805
Drew	1,814,132
Drew	Re 21,762
Drew	2,227,444
Kellgren et al	2,444,830
Drew	2,236,527
Kellgren	2,410,078

Drew	2,173,829
Kellgren	2,206,899

• • • • • • • • • • •

I might add that we do not have access to patent applications which are still pending in the Patent Office. Since none of the patents listed above discloses a polyvinyl film-type tape and inasmuch as Minnesota Mining is now actively engaged in the Patent Office patent applications directed to various features of such polyvinyl resin tapes and that such applications may result in the grant of patents on this subject matter in the future. That is a risk which cannot be avoided. Even if a patent should eventually issue, you incur no liability for infringement prior to the actual date of issue.

Very truly yours,

/s/ E. T. LeGates

Excerpts from Defendants' Exhibit 42 (Philadelphia Depositions)

Paper given before American Chemical Society
"Resinous Plasticizers Derived from Sebacic Acid"
1944

Certain of the polyesters combine to a remarkable degree the good qualities of the plasticizers of both broad classifications. An additional advantage is the possibility of their being "tailor-made" to meet predetermined requirements by adjusting the molecular weight level and by proper choice of raw materials.

Excerpts from Defendants' Exhibit 50 (Philadelphia Depositions)

"Plasticizers — Paraplex — Monoplex"
Rohm & Haas Company, 1954

INTRODUCTION

The resourcefulness and growth of modern chemical technology are perhaps nowhere better illustrated than in the diversity and quantity of plastic materials which have been offered to industry in recent years. Of these, few have shown more spectacular gains than the vinyl resins and their plasticizers.

This position of vinyl products at the forefront of the plastics industry has arisen, at least in part, because of improvements in plasticizers. Manufacturers of vinyl products, having thus been given incentive to develop higher quality materials and new uses have, in turn, set increasingly higher standards for the entire industry. Research investigators, therefore, focused their efforts on tailoring plasticizers to meet specific, often stringent, application and process requirements. The final result? Compounders of vinyl products are now able to choose from a variety of plasticizers ranging from simple monomeric esters to complex, high molecular weight polymers, such as the Paraplex series of polyesters. Rohm & Haas plasticizers, for example, can be employed alone or in combination with one another to meet — and even to exceed — virtually every demand made upon them, both in processing or service. No compounder, today, need lack for a plasticizer or plasticizer combination adaptable to his processing equipment or to the type of product he wishes to produce.

• • • • • • • • • •

Electrical Tape

The requirements for electrical tape are very critical because of the need for a combination of good electrical properties, resistance to migration into the rubber-based adhesives employed, and freedom from exudation on exposure to high humidity.

The electrical tape field has expanded rapidly over the past few years. Its future growth, however, will depend to a large extent upon the maintenance of high quality standards necessary for satisfactory performance in service. In general, only polymeric plasticizers should be considered for formulations for electrical tape, largely because of the danger of migration.

Excerpts from Defendants' Exhibit 25

"Plasticizers for Use With Polyvinyl Chloride and Copolymers"
Rohm & Haas Company, 1946

It will be noted that the formulations discussed herein, in most cases, involve the use of only one plasticizer. This does not mean to imply that binary or ternary systems are not to be considered. Commercial practice has proven that, in many systems, the use of a "compatibilizing" plasticizer will make possible the use of one showing desirable properties, or reduced cost, which otherwise could not be used. A complete study of such binary or ternary systems, however, is not within the scope of this booklet, but it is expected that more complete data thereon will be made available in the future.

Excerpts from Defendants' Exhibit 12

(St. Paul Depositions)

Period Ending
October 15, 1944

TO: DR. H. N. STEPHENS
Research Department
Adhesive Section

Semi-Monthly Report

• • • • • • • • • • •

(Page 4)

AR 42—Elastic Plasticizers—Dr. W. E. Lundquist and Esther Eastwold

Two solutions of Vinylite VYNS, one containing 33% Paraplex G25 based on the PVC, and the other in addition to the plasticizer containing 133% Titanox on the PVC, were each coated on cellophane in the Tape Lab. The pigmented film was too short for use, while the other was a clear, satisfactory film which will be coated with adhesive and made into tape rolls.

Blends of Geon latex and polyethyl acrylate emulsion have been treated with thickeners and films cast. Satisfactory films have not yet been produced.

A film consisting of Vinylite VYNS, Paraplex G25, and dioctyl phthalate (72:18:10) was produced on the calendar for the Electrical Tape Lab. The film calendered easily and was clear. Its strength was as great as that of a comparable film made of Vinylite VYNW. Standard GRS adhesive has been coated on the film and comprehensive tests are under way to determine if the plasticizer will affect the adhesive. Two substantially polyvinyl chloride polymers of

relatively low molecular weight, Vinylite VYHH and VYLF, have been plasticized in solution of methyl ethyl ketone with each of DOP, TCP and PG25. The films were not considered satisfactory, because of low tensile strength.

* * * * * * * * * * *

/s/ J. O. HENDRICKS 10-24-44
Adhesive Research Laboratory

Excerpts from Defendants' Exhibit 2

(St. Paul Depositions)

(Handwritten)

"89575 D

1300 g.	VYNS	72
324 g.	PG25	18
180 g.	DOP	10
39 g.	Ca Stearate	3

Milled at 300° F without discoloration.
Calendered 220° F on to varnished cloth liner.
Given to Ralph Oace."

Excerpts from Defendants' Exhibit 10

EXPERIMENT
TAPE DEPARTMENT

(2) Electrical Tape

EXPERIMENTAL PRODUCTION REPORT
PSL-9556 January 17, 1945

SUBJECT: Vinyl Chloride - Vinyl Acetate Film for Electrical Tape.

OBJECT: Production of pressure sensitive moldproof and waterproof tape.

PROCEDURE:

Vinylite (V.Y.N.S.) will be compounded, calendered, and coated in production.

ATTENTION: Rubber Compounding Department

Lots 1—PSL-9556:	137.00#	V.Y.N.S.
	39.20#	Paraplex G-25
	20.40#	Dioctyl Phthalate-(D.O.P.)
	4.30#	Calcium Stearate
	200.90#	

PROCEDURE:

Mix V.Y.N.S. and calcium stearate together; then add Paraplex G-25 and Dioctyl Phthalate (D.O.P.) mixing thoroughly, and adding to the 60" mill with maximum heat applied, to the rolls for the 15 minute warm-up.

Batch should be milled thoroughly for approximately one hour and small portions supplied to the production calender while still hot. (Call Author while Milling—Extension No. 338)

ATTENTION: RUBBER COMPOUNDING (Calendering)

Sheet the milled base to .006 caliper, winding onto a varnish cloth liner (Varnoseal). Use maximum temperatures on top and center rolls, and keep the bottom roll cold. Knife setting should be 19".

ATTENTION: TAPE COATING DEPARTMENT

Please coat all the material made up from the above calender and mill batch as follows:

Schedule on a 28" machine which has a primer tank and steam drum attachment.

Backing: Calendered ~~V.Y.~~N.S. (Vinylite)

The backing will have a varnish cloth liner, used as a carrier, and the vinylite side should be coated at 7 grains per 4x6.

Primer: P-34

Adhesive: A-341 (7 grains)

Oven Temperatures: top — 110° — 115°F
Center — 135° — 145°.F

The center temperature should be increased to avoid bubbling if the material is not dry.

Speed: 5 yards per minute

Liner: RP-124

ATTENTION: TAPE SLITTING DEPARTMENT

Refer to SL-9644. Use the vinylite slitting technique.

Call Author before slitting. (Extension 338).

Rolls should be wound on 1" cores x 36 yards.

50% of material slit at ¾"
25% of material slit at ½"
25% of material slit at 1"

RBS/ldf

Robert B. Snell

LIBRARY
SUPREME COURT, U.S.

No. 673

DEC 16 1957
JOHN T. FEY, Clerk

United States Court of Appeals for the Fourth Circuit.

No. 7298.

SEARS, ROEBUCK AND COMPANY AND
PLYMOUTH RUBBER COMPANY, INC.,
DEFENDANTS, APPELLANTS,

v.

MINNESOTA MINING AND MANUFACTURING
COMPANY,
PLAINTIFF, APPELLEE.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE
MIDDLE DISTRICT OF NORTH CAROLINA.

RECORD APPENDIX TO BRIEF FOR DEFENDANTS, APPELLANTS.

THORNTON H. BROOKS,
Attorney for Defendants, Appellants.

HECTOR M. HOLMES,
H. L. KIRKPATRICK,
E. T. LEGATES,
Of Counsel.

ADDISON C. GETCHELL & SON, INC., LAW PRINTERS, BOSTON.

Index.

Findings of facts and conclusions of law A1
Findings of fact A1
Conclusions of law A14
Decree A15
Opinion A18
Excerpts from discovery depositions of Louis Klein, E. M. Beavers, Arthur L. Blount and John Myers, taken by defendant at Philadelphia, March 22-23, 1955 A25
Louis Klein
Direct A25
Cross A26
E. M. Beavers
Direct A28
Arthur L. Blount
Direct A31
John Myers
Direct A33
Excerpts from deposition of Irving C. Eaton, taken by defendant at Bridgeport, Connecticut, April 7, 1955 A34
Irving C. Eaton
Direct A34
Cross A37
Excerpts from deposition of Paul Shalita, taken by plaintiff in New York, April 20, 1955 A38
Paul Shalita
Direct A38
Defendants' Exhibit 60A A39
Excerpts from discovery deposition of R. W. Lundbohm, taken by defendant at Boston, Massachusetts, June 9, 1955 A41

R. W. Lundbohm
Direct A41
Excerpts from discovery depositions of Esther E. LePage, Warren D. Hurd, Ralph J. Oace and William E. Lundquist, taken by defendant at St. Paul, Minnesota, January 31-February 4, 1955 A47
Esther E. LePage
Direct A47
Warren D. Hurd
Direct A50
Ralph J. Oace
Direct A51
William E. Lundquist
Direct A52
Excerpts from testimony at trial A54
Hubert James Tierney
Direct A54
Cross A61
John M. DeBell
Direct A77
Cross A104
Redirect A109
Walter M. Bieringer
Direct A110
Redirect A115
Frank L. Kozol
Direct A116
Cross A119
Excerpts from deposition of Morris M. Danovitch, taken by plaintiff at Boston, Massachusetts, February 9-16, 1955 A121
Morris M. Danovitch
Direct A121
Cross A125

Redirect A126
Recross A127
Excerpts from Plaintiff's Exhibit 2—file history of the original Oace et al. patent in suit No. 2,559,990 A128
Original claim 3 A128
Excerpt from Patent Office action of March 4, 1947 A128
Excerpt from Patent Office action of May 11, 1948 A129
Excerpt from Amendment of November 8, 1948 A130
Excerpt from Applicants' remarks, accompanying Amendment of November 8, 1948 A131
Excerpt from Applicants' remarks accompanying Amendment of November 4, 1949 A131
Excerpt from Patent Office action of May 24, 1950 A132
Excerpt from Applicants' remarks accompanying Amendment of October 12, 1950 A132
Excerpts from Plaintiff's Exhibit 4, file history and contents of reissue patent in suit, re No. 23843 A133
Original claim 7 A133
Excerpt from inventors' oath accompanying reissue application A133
Excerpt from Patent Office action of August 7, 1952 A134
Amendment of May 12, 1953—addition of new claim 16, with amendments. (This claim became claim 6 of the reissue patent) A134
Excerpts from affidavit of William E. Lundquist, dated May 8, 1953, accompanying amendment of May 12, 1953 A136
Excerpts from Patent Office action, May 29, 1953 A137
Excerpts from Amendment of June 24, 1953 A137
Excerpts from Defendants' Exhibit 7, being a report dated December 20, 1944, of Esther Eastwold and W. E. Lundquist, entitled "Elastic Solid

Plasticizers—Tape Backings of Plasticized Vinyl Polymer Films," for period from February 1, 1944, to September 20, 1944 A137
Excerpts from Defendants' Exhibit 8, entitled "Elastic Solid Plasticizers—Stretchable Tape Backings," being report prepared by Esther Eastwold and Dr. W. L. Lundquist, dated July 7, 1945, and being report for the period from September 20, 1944 to June 30, 1945 A139
Excerpt from Defendants' Exhibit 9, report prepared by Esther Eastwold [Mrs. LePage] for period August 15 to February 8, 1946, and dated February 8, 1946 A139
Excerpts from Defendants' Exhibit 12, "Semi-Monthly Report" of Esther Eastwold (Mrs. LePage) A140
Excerpt from Defendants' Exhibit 6 A147
Defendants' Exhibit 58-G A149
Defendants' Exhibit 58F-2 A151
Defendants' Exhibit 58-F A153
Excerpts from Defendants' Exhibit 52 A155
Excerpt from Defendants' Exhibit 23 A159
Excerpts from Defendants' Exhibit 24 A161
Patents A165

RECORD APPENDIX.

In the District Court of the United States for the Middle District of North Carolina, Greensboro, Division.

No. 878-G.

MINNESOTA MINING AND MANUFACTURING COMPANY, a Corporation of Delaware, *Plaintiff*,

v.

SEARS, ROEBUCK AND COMPANY, a Corporation of New York, *Defendant*,

and

PLYMOUTH RUBBER COMPANY, INC., *Defendant-Intervenor*.

Findings of Fact and Conclusions of Law.

FINDINGS OF FACT

1. The foregoing identified and numbered suits were consolidated for the purposes of trial by order of this Court dated January 7, 1955.

2. The jurisdiction of this Court is based on the fact that this is a suit arising under the Patent Laws of the United States; and venue is admitted.

3. The several defendants admit plaintiff's ownership of the United States Letters Patent No. 2,559,990 issued to the plaintiff on July 10, 1951, and Reissue Letters Patent No. 23,843 issued to the plaintiff on June 29, 1954, the patent involved in this litigation.

4. Plymouth Rubber Company, Inc., the manufacturer of the most of the accused tape sold by the defendants herein, at the time of the Pretrial conference held in these consolidated cases on September 21, 1955, intervened of

record as defendant-intervenor in No. 878-G, and adopted the Answer and all other pleadings, including Answers to Interrogatories, Answers to Requests for Admissions, and Depositions, heretofore filed in No. 878-G by or on behalf of the defendant Sears, Roebuck and Company.

5. There are involved as accused structures in these consolidated suits, as will appear from other Findings of Fact herein, pressure-sensitive vinyl plastic electrical insulating tape made by two manufacturers and sold by the respective defendants under the brand names indicated, and plasticized as set forth:

Defendant	Manufacturer	Brand Name	Plasticizer	Tape Example
Plymouth Rubber Company, Inc.	Plymouth	Plymouth	Majority production G-40; Minority, G-25	PX 14 DX 32
Sears, Roebuck and Company	Plymouth	Homart	"	PX B-3
Pine State Electric Supply Co., Inc.	Plymouth	S I	"	PX 18
The Noland Company, Inc.	Plymouth	Plymouth	"	PX 15
Scott-Parish Electrical Supply Company	Plymouth	Plymouth	"	PX 14
Dixie Radio Supply Company of Charlotte, Inc.	Plymouth Technical Tape Corp.	Plymouth Tuck	" R-2H & G-60	PX 16 PX 12

6. The defendant-intervenor, Plymouth Rubber Company, Inc., is the manufacturer of the Plymouth Plastic Electrical Tape, charged to infringe.

7. The defendant Sears, Roebuck and Company, prior to the filing of the complaint in 878-G and subsequent to the

grant to the plaintiff of the original of the reissue patent here involved, and continuously thereafter, has sold pressure-sensitive vinyl plastic electrical tape made by Plymouth under the private brand name of "Homart".

8. The defendant Pine State Electric Supply Co., Inc., prior to the filing of the complaint in 879-G and subsequent to the grant to the plaintiff of the original of the reissue patent here involved, has sold vinyl plastic pressure-sensitive electrical tape manufactured by Plymouth Rubber Company, Inc., privately branded "S I" for Superior Insulating Tape Co. of Saint Louis, Missouri, which company sold such tape to said defendant.

9. The defendant Dixie Radio Supply Company of Charlotte, Inc., prior to the filing of the complaint in 879-G and subsequent to the grant to the plaintiff of the original of the reissue patent here involved, has sold Plymouth Plastic Electrical Tape.

10. The defendant Dixie Radio Supply Company of Charlotte, Inc., prior to the filing of the complaint in 879-G and subsequent to the grant to the plaintiff of the original of the reissue patent here involved, has sold No. 330 "Tuck" Vinyl Plastic Insulating Tape manufactured by Technical Tape Corporation of New York.

11. The defendant Scott-Parish Electrical Supply Company, prior to the filing of the complaint in 879-G and subsequent to the grant to the plaintiff of the original of the reissue patent here involved, and continuously thereafter, has sold Plymouth Plastic Electrical Tape.

12. The defendant The Noland Company, Inc., prior to the filing of the complaint in 879-G and subsequent to the grant to the plaintiff of the original of the reissue patent here involved, and continuously thereafter, has sold Plymouth Plastic Electrical Tape.

13. The plaintiff in its charge of infringement relies on claims 1, 3, 4, 6, 7, 8 and 9 of its Reissue Patent No. 23,843.

Of these claims, numbers 1, 3 (except for correction of temperature and 4 are identical with similarly numbered claims of the original patent; and claims 6, 7, 8 and 9 are reissue claims. Of the claims in issue, claims 1 and 6 may be taken as typical.

14. Over 90% of Plymouth's sales from the date of issue of the original patent to October 3, 1955 of pressure-sensitive vinyl plastic insulating tape (other than to the government and agencies thereof) has been of such tape made using a plasticizing material other than G-25. The majority of the Plymouth tape charged to infringe has been made using Paraplex G-40 as the plasticizing material for the vinyl film backing.

15. Plymouth first sold pressure-sensitive vinyl plastic insulating tape containing recent-vintage Paraplex G-25 as the plasticizer in the tape backing (other than to the government or an agency thereof) on or about June 24, 1954. This sale was to Sears, Roebuck and Company.

16. The plaintiff's pressure-sensitive plastic electrical insulating tapes, for example "SCOTCH" brand No. 33 and No. 22 Electrical Tapes, are made in accordance with teachings of the patent in suit.

17. The plaintiff's tapes made under the teachings of the patent in suit met with an immediate commercial success due to their inherent merit. Plaintiff's sales, following the first small sale in February 1945, rose from about $8,000.00 in 1945 to more than $8,000,000.00 in 1953, with an advertising expense over the period of less than 2% of sales.

18. In one of its principal uses, as an electrical splicing tape, the tape of the patent in suit replaces both rubber electricians' tape and friction tape. The two manufacturers of the tape here accused truthfully so represent to the trade, as do the defendant sellers.

19. Prior to the invention by the patentees of the tape of the patent in suit, tape of such kind did not exist. The in-

vention of the patent in suit provided a tape which was an entirely new article of commerce, different in character and kind from anything which preceded it.

20. It was not for want of available materials that the tape of the invention of the patent in suit was not produced earlier. The evidence discloses that the ingredients needed for the formation of the film backing of the tape, as well as those needed for the adhesive and primer, were known in the art and available commercially for a long time, more than ten years, anterior to the invention of the subject matter of the patent in suit.

21. A ready market existed for the tape of the patent in suit many years before it appeared.

22. When these suits were filed, the tape of a third manufacturer was involved, Van Cleef Bros., a division of Johns-Manville Corporation. That manufacturer acquired a license under the patent in suit as of August 30, 1955. Its royalty payment for the first month under the license was $6,243.00, calculated at 5% of sales.

23. The "Homart" plastic tapes made and packaged for the defendant Sears, Roebuck and Company, more recently by Plymouth Rubber Company and earlier by Van Cleef Bros. Co., a division of Johns-Manville Corporation, via Accurate Manufacturing Company, were similar. Both were pressure-sensitive, stretchable and retractable vinyl plastic insulating tapes, similarly advertised and sold and employed for similar uses, and indistinguishable from each other except for a coding or marking on the containers thereof.

24. The patent in suit exhibits invention of a high order. It took the chief chemist of Plymouth Rubber Company, Inc., under mandate of his superiors, from 1948 to 1950 to duplicate the tape of the patent, with the plaintiff's product before him, even though he was experienced in vinyl resins

and the use of plasticizers, and was familiar with the published specifications of plaintiff's No. 33 plastic tape.

25. The accused tapes are not distinguishable in appearance from plaintiff's tape except by examination of labels.

26. Others tried, without success, to make a pressure-sensitive tape on a plasticized vinyl film backing. Tierney tried in 1938, but all attempts were unsatisfactory and the pressure-sensitive adhesives became very soft and pasty. Another employee of plaintiff tried in 1941, but met with failure and abandoned the project.

27. The inventors, prior to the production of the successful tape as disclosed by the patent in suit, collaborated for many months in experimental work, during the course of which a series of over 200 experiments was conducted with a large number of different formulations.

28. None of the five items of prior art ultimately relied upon by the defendants (selected from an initial citation of over 25) discloses the tape of the patent in suit. At most, taken separately, each discloses the antiquity of an element or ingredient of the article of the patent. No one of these patents teaches, or even remotely suggests, how to produce the tape of the Oace patent. The prior art relied upon is even less pertinent than the Schmidt patent No. 2,332,265, which was a file wrapper reference, and which was first pleaded, and was then withdrawn by defendants during the trial. The prior art relied on at the trial is as follows:

Groff	No. 1,966,856
Drew	No. 2,177,627
Maibauer	No. 2,320,442
Sears	No. 2,413,673
Bierbrauer	No. 206,871 (Swiss)

29. The subject matter of the Oace et al patent in suit is an electrical insulating tape in the form of a relatively thin (about 4 to 20 mils) backing film, which is easily stretchable

(by simple hand pulling) and readily retractable, combined with a well bonded water-insoluble, normally tacky and pressure-sensitive adhesive coating, the backing film being formed from a plasticized vinyl chloride polymer which is in permanent equilibrium with the adhesive coating in order that the adhesive will not soften (become pasty) or lose tack (become non-adherent), thereby providing an insulating tape that may be wound in a roll and unwound therefrom without delamination of the tape or offsetting of the adhesive.

30. The central problem to which the patent in suit is addressed, and which it solved, was to provide an insulating tape in the form of an easily stretchable and highly elastic pressure-sensitive adhesive tape comprising a well-bonded, water-insoluble, non-corrosive, normally tacky and pressure-sensitive coating on a plasticized vinyl chloride polymer film which is in permanent equilibrium with the adhesive.

31. The patent in suit teaches persons skilled in the art that ethyl acrylate polymer may be used as the plasticizer for the film backing of the tape of the patent. The patent discloses a plasticizing system which is satisfied by one or more ingredients of plasticizing material. There is in evidence a roll of pressure-sensitive insulating tape wherein the film backing is 100 parts of VYNS vinyl chloride copolymer resin plasticized with 50 parts by weight of ethyl acrylate polymer resin.

32. The Oace reissue specification introduced no new matter over the specification of the original Oace patent. The only changes in the reissue patent specification from the specification of the original patent are the italicized portions appearing in columns 1, 8 and 9. None of the added portions makes a new disclosure of invention but rather are merely further discussions of the advantages claimed for this type of tape, or definitions.

33. Each of the claims in suit particularly points out and distinctly claims the invention disclosed in the patent in suit.

34. The reissue patent is for the same invention as the original patent. There is no change in disclosure; and the claims of the reissue comprehend no more than the inventors disclosed and intended to cover originally.

35. The original Oace patent was partly inoperative clearly and distinctly to cover, in literal terms, the inventions disclosed therein and intended to be claimed. This defect arose through error, and without any deceptive intention.

36. Lack of patent experience on the part of the applicants (Oace et al), and lack of understanding of the invention on the part of their patent solicitors constituted error justifying the Patent Office in its grant of the clarifying reissue.

37. Plasticization and migration are both physical phenomena.

38. Paraplex G-25 and Paraplex G-40 are respectively the polymerized reaction products of sebacic and adipic acid with a dihydric alcohol; and each is a soft, viscous linear polyester alkyd plasticizer resin.

39. In the process of polymerization, the composition of the resultant product depends upon the conditions of the polymerization, for example, time, temperature, the catalyst employed, and other factors, so that different types of polymers can be produced as desired.

40. Paraplex G-25 and Paraplex G-40 are represented by the manufacturer thereof to be "tailor-made", and to combine to a marked degree many of the desirable features of the more liquid ester-type plasticizers, such as dioctyl phthalate, with those features obtainable in resinous plasticizers.

41. Paraplex G-25 is represented by its manufacturer to be "a soft, tacky, viscous liquid which pours slowly at room temperature". Paraplex G-40 has even a lower viscosity than Paraplex G-25 at "slightly elevated temperatures".

42. Polyester plasticizers for vinyl chloride copolymers, such as Paraplex G-25 and Paraplex G-40 made by Rohm & Haas, may be fractionated by known procedures, but not by distillation, into the more viscous higher-molecular-weight portions and the more liquid lower-molecular-weight portions of the original material.

43. The more liquid portion of Paraplex G-40 is a liquid adipyl ester plasticizer. Both adipyl ester plasticizers and phthalyl ester plasticizers are plasticizers for vinyl chloride polymers; both are esters of organic carboxylic acids; both are liquid; and both are non-volatile.

44. Sebacic, adipic and phthalic acid esters are available as liquid plasticizers for vinyl chloride polymers, offered in commerce, and referred to in the literature in the same grouping; and all function by physical action in the same way to produce soft, pliable, stretchable and elastic polyvinyl chloride film.

45. When the lower-molecular-weight fraction of Paraplex G-40 is blended with the more viscous higher-molecular-weight portion, a plasticizer is obtained which, by physical action in combination with vinyl chloride polymers, functions in the same way to give essentially the same results as the combination of Paraplex G-25 and dioctyl phthalate in the ration of 2 to 1.

46. The more liquid lower-molecular-weight portion of Paraplex G-40 constitutes about 33% thereof. This portion is a liquid adipyl ester plasticizer; and is the equivalent of a liquid phthalyl ester plasticizer. The ratio of two parts of higher-molecular-weight viscous resinous plasticizer to one part of more liquid lower-molecular-weight plasticizer found in Paraplex G-40 is within the recommended range

of examples of the Oace patent. The use of Paraplex G-40 as the plasticizing material in the accused Plymouth tapes produces the same results in the same way by the same or equivalent means as the examples of the patent in suit.

47. A person skilled in the art can produce the tape as disclosed by the Oace patent by following the teachings of the patent. Plaintiff's commercial tape is made in accordance with the teachings of the patent. The accused tape was not derived from the prior art; rather it was produced by Plymouth and Technical Tape, respectively, essentially by duplicating plaintiff's commercial tape.

48. The purpose of vacuum stripping during the manufacture of Paraplex G-25 and Paraplex G-40 by Rohm & Haas is to remove free glycol and water which may result from the poly-esterification, and does not remove ester material of the order of 300, 400 or 500 molecular weight. The building unit, or monomer, of both G-25 and G-40 has a molecular weight falling within the range of about 300-350.

49. Paraplex G-25, when the applicants for the patent in suit worked with it in 1944 and 1945, was significantly different than it is today.

A. The attempt of Oace et al in 1944 to make their tape with Paraplex G-25 as the sole plasticizer led to a tape which was unsuccessful and quickly lost its tack.

B. Danovitch of Plymouth could not make tape with G-25 as the sole plasticizer in the period from 1948-1950.

C. In late 1943 and 1944, Paraplex G-25 was in the process of development for manufacture on both a pilot-plant and plant scale. Its composition by that time had been defined research-wise "at least in respect to its major features". The first production batch of Paraplex G-25 was not made until early 1944.

D. In the production of Paraplex G-25 in recent years, Rohm & Haas, the manufacturer, has held the product to narrower specifications.

E. Paraplex G-25, like other polymerized plasticizers, can be tailored by process controls, and is so tailored, to get desired results to meet customers' demands.

F. Paraplex G-25 of recent vintage as the sole plasticizer will make suitable tape today, although still not as good as when some additional low molecular weight plasticizer is used.

G. Paraplex G-25 of 1944 and 1945 vintage had an oil film on its surface in the containers; recent vintage Paraplex G-25 does not have an oil film.

H. Paraplex G-25 is not a chemically-pure compound, even today.

50. The use of Paraplex G-25 of recent vintage as the plasticizer material in the film backing makes a tape of satisfactory aging life, fully responsive to the disclosure of the patent, although there is a relatively low amount of tack loss. The quality of such tape is improved when a small amount of a more liquid plasticizer, such as dioctyl phthalate, is added to the plasticizer material.

51. The more liquid lower-molecular-weight portion of the recent vintage Paraplex G-25 constitutes about 11% thereof. This portion is a liquid sebacyl ester plasticizer. The ratio of about 8 or 9 parts of higher-molecular-weight viscous alkyd resin plasticizer to about 1 part of more liquid lower-molecular-weight plasticizer found in this Paraplex G-25 is within the compass and scope of the Oace patent. The use of Paraplex G-25 as the plasticizing material in the accused Plymouth tapes produces the same results in the same way by the same or equivalent means as the examples of the patent in suit.

52. The plasticizing materials herein found to be full equivalents for those specifically recited ingredients disclosed in the patent in suit are either tailor-made for the purpose or are normal, well-known substitution products for the material specified in the patent, and which would be used by persons skilled in the art without experimentation.

53. The accused Plymouth Plastic Electrical Tape which utilizes Paraplex G-40 as the plasticizing material, made and sold by the defendant Plymouth Rubber Company, Inc., and sold by defendants in these consolidated cases, responds to all of the requirements of each of claims 1, 3, 4, 6, 7, 8 and 9 of reissue patent in suit, and infringes each of said claims.

54. The accused Plymouth Plastic Electrical Tape which utilizes Paraplex G-25 as the plasticizing material, made and sold by the defendant Plymouth Rubber Company, Inc., and sold by the defendant Sears, Roebuck and Company, responds to all of the requirements of each of claims 1, 3, 4, 6, 7, 8 and 9 of the reissue patent in suit, and infringes each of said claims.

55. The defendant Plymouth Rubber Company, Inc., uses the same equipment for mixing, milling, calendering and coating the accused tapes that is used in the manufacture or processing of other articles before the issue of the original of the patent in suit. The evidence shows that the manufacture and sale of the accused tape by Plymouth was initiated, using existing equipment and existing sales force, in order to protect its business in the manufacture and sale of rubber electricians' tape and friction tape. None of the defendants has offered any evidence that any substantial preparation was made for the purpose of manufacturing or selling the accused tape.

56. The defendant Plymouth Rubber Company, Inc., commenced the manufacture and sale of the accused tape late in 1950.

57. The defendant Plymouth Rubber Company, Inc., has failed to establish any facts to support laches or inequity on the part of the plaintiff to deny relief to the plaintiff. The taking out of insurance by Plymouth and its seeking the advice of patent attorneys was not communicated to the plaintiff. A report of patent counsel was concealed from the plaintiff, after inquiry, until this trial was in its last day.

58. Plaintiff was not guilty of laches or inequity either in the filing or prosecution of the Oace reissue application, or in the commencement of the instant actions.

59. The "Tuck" Vinyl Plastic Insulating Tape sold by the defendant Dixie Radio Supply Company of Charlotte, Inc., and made by Technical Tape Corporation of New York, comprised a copolymer of vinyl chloride and vinyl acetate plasticized with R-2H and Paraplex G-60.

60. R-2H is a viscous, non-migrating alkyd plasticizer resin of the polyester type, like Paraplex G-25 and Paraplex G-40. It is liquid, fluid and viscous. It is marketed by Carbide & Carbon Chemical Corporation.

61. Paraplex G-60 is a liquid ester plasticizer made by Rohm & Haas for plasticizing vinyl chloride. Its number average molecular weight is 1000, compared with 390 for dioctyl phthalate, 6000 for Paraplex G-40, and 8000 for Paraplex G-25.

62. Paraplex G-60 and R-2H are respectively the equivalents of dioctyl phthalate and Paraplex G-25. It would be logical for a man skilled in the art of plasticizing vinyl chloride resins to substitute Paraplex G-60 for dioctyl phthalate; and R-2H for Paraplex G-25, both being viscous low-acid-number alkyd plasticizer resins. He would expect to get the same results in the same way by using the same or equivalent means, and would get the same results, as shown by Plaintiff's Exhibit 12 herein.

63. The "Tuck" vinyl plastic insulating tape sold by the defendant Dixie Radio Supply Company of Charlotte, Inc., and manufactured by Technical Tape Corporation of New York, responds to all of the requirements of each of claims 1, 3, 4, 6, 7, 8 and 9 of the reissue patent in suit.

64. Each of the defendants herein by its acts and conduct of infringement has and does threaten to continue to infringe.

Conclusions of Law

1. The Court has jurisdiction of the subject matter of these suits and of the parties thereto.

2. The original Oace et al patent No. 2,550,990 was in all respects duly and lawfully reissued as Reissue No. 23,843.

3. Claims 1, 3, 4, 6, 7, 8 and 9 of the Oace Reissue patent No. 23-843, all of the claims in issue, are each valid.

4. Each of the aforesaid claims 1, 3, 4, 6, 7, 8 and 9 of said reissue patent has been infringed by the defendant-intervenor Plymouth Rubber Company, Inc., in the manufacture, use, sale, and offer for sale of Plymouth Plastic Electrical Tape, "Homart" Plastic Electrical Tape, and "S I" Plastic Electrical Tape, each being a pressure-sensitive adhesive insulating tape having a backing of vinyl chloride polymer plasticized with Paraplex G-40 or Paraplex G-25.

5. Each of the aforesaid claims 1, 3, 4, 6, 7, 8 and 9 of said reissue patent has been infringed by defendant Sears, Roebuck and Company in the use, sale and offer for sale of "Homart" Plastic Electrical Tape made by Plymouth Rubber Company, Inc.

6. Each of the aforesaid claims 1, 3, 4, 6, 7, 8 and 9 of said reissue patent has been infringed by the defendant Scott-Parish Electrical Supply Company and The Noland

Company, Inc., in the use, sale, and offer for sale of Plymouth Plastic Electrical Tape.

7. Each of claims 1, 3 and 4 of said reissue patent has been infringed by the defendant Pine State Electrical Supply Co., Inc., in the use, sale, and offer for sale prior to June 29, 1954 of "S I" Plastic Electrical Tape made by Plymouth Rubber Company, Inc.

8. Each of claims 1, 3 and 4 of said reissue patent has been infringed by the defendant Dixie Radio Supply Company of Charlotte, Inc., in the use, sale, and offer for sale prior to June 29, 1954 of (a) Plymouth Plastic Electrical Tape and (b) "Tuck" Vinyl Plastic Insulating Tape, the latter made by Technical Tape Corp., New York City.

9. The plaintiff has not been guilty of any inequity, laches, or estoppel to deny it full relief; and no defendant has acquired any intervening right.

10. The plaintiff is entitled to a decree providing for (1) a permanent injunction against each defendant and the defendant-intervenor prohibiting further infringing acts, (2) damages against each defendant and the defendant-intervenor; and (3) costs.

The Court finds the facts and makes the conclusions of law which are tendered by the plaintiff, as hereinabove set forth, and a decree shall be entered in accordance with said findings of fact and conclusions of law.

This the 12 day of June, 1956.

JOHNSON J. HAYES
United States Judge.

Decree.

THIS CAUSE came on to be tried before the Court, sitting without the intervention of a jury, and the Court having

considered the evidence introduced by the parties, including stipulations, exhibits, and the entire record in the cause, as well as the briefs and arguments of counsel for the respective parties; and the Court having heretofore made and filed its findings of fact and conclusions of law, as the same appear of record, which are made a part hereof by reference thereto;

IT IS, THEREFORE, ORDERED, ADJUDGED AND DECREED as follows:

(1) That United States Letters Patent No. 2,559,990 was duly and lawfully issued to the plaintiff on July 10, 1951, and was in all respects duly and lawfully reissued to the plaintiff on June 29, 1954 as Reissue No. 23,843; and that the plaintiff is the sole and exclusive owner of the full and entire right, title and interest in and to said Letters Patent and the reissue thereof, together with all rights of action for past infringement thereof;

(2) That said Reissue Patent No. 23,843 is good and valid in law as to claims 1, 3, 4, 6, 7, 8 and 9, all of the claims in issue herein;

(3) That the defendant-intervenor, Plymouth Rubber Company, Inc., has infringed each of the aforesaid claims 1, 3, 4, 6, 7, 8 and 9 of said reissue patent by the manufacture, use, sale and offer for sale of pressure-sensitive stretchable and retractable plastic tape, designated as "Plymouth" Plastic Electrical Tape, "Homart" Plastic Electrical Tape and "S I" Plastic Electrical Tape, and illustrated by Plaintiff's Exhibits 14, 15, 16, 18 and B-3 and by Defendants' Exhibit 32;

(4) That the defendant, Sears, Roebuck and Company, has infringed each of the aforesaid claims 1, 3, 4, 6, 7, 8 and 9 of said reissue patent by the use, sale and offer for sale of pressure-sensitive stretchable and retractable plastic tape, designated as "Homart" Plastic Electrical Tape, made by Plymouth Rubber Company, Inc., and illustrated

by Plaintiff's Exhibits 14, 15, 16, 18 and B-3, and by Defendants' Exhibit 32;

(5) That a writ of injunction issue out of and under the seal of this Court, directed to the defendant, Sears, Roebuck and Company, and to the defendant-intervenor, Plymouth Rubber Company, Inc., perpetually restraining and enjoining them and each of them, and each of their directors, officers, associates, agents, attorneys, confederates and employees, and those in active concert or participating with them or either of them, from directly or indirectly making, selling, offering for sale, using, or causing to be made, sold or used, any adhesive sheeting or adhesive tape the same as the adhesive sheets or adhesive tapes identified as Plaintiff's Exhibits 14, 15, 16, 18 and B-3, and by Defendants' Exhibit 32, or any other pressure-sensitive stretchable and retractable plastic tape or any device utilizing or embodying the inventions of claims 1, 3, 4, ~~6, 7~~, 8 and 9 of said Letters Patent Reissue No. 23,843; or from in any manner infringing upon any of said claims of such Letters Patent;

(6) That the plaintiff, Minnesota Mining and Manufacturing Company, shall have and recover of the defendant-intervenor, Plymouth Rubber Company, Inc., the damages which the plaintiff has sustained by reason of the aforesaid infringements by said defendant-intervenor;

(7) That the plaintiff, Minnesota Mining and Manufacturing Company, shall have and recover of the defendant, Sears, Roebuck and Company, the damages which the plaintiff has sustained by reason of the aforesaid infringements by said defendant;

(8) That this cause shall be referred to Rufus Reynolds, Esquire, as Special Master, to ascertain the damages adequate to compensate the plaintiff for the several infringements by the defendant, Sears, Roebuck and Company, and by the defendant-intervenor, Plymouth Rubber Company, Inc.; and

(9) That the plaintiff recover of the defendant and the defendant-intervenor the taxable costs of the plaintiff in this suit, and such costs and expenses as may be incurred by the Special Master in connection with his services herein, and that the plaintiff shall have judgment and execution against the said defendants for said costs.

Entered this 12 day of June, 1956.

JOHNSON J. HAYES
United States District Judge.

Opinion.

[June 4, 1956.]

HAYES, District Judge.

This infringement suit is brought by the assignee of a patent on a pressure-sensitive stretchable and retractable vinyl plastic tape primarily for use as an electrical insulating tape. The original application was filed by Oace, Snell and Eastwold January 12, 1946 and Patent 2,559,990 issued July 10, 1951, naming them as assignors to the Minnesota Mining and Manufacturing Co. For convenience it will be referred to as the Oace Patent. Also involved is Reissue Patent 23,843 of June 29, 1954, on application filed July 9, 1952. All available defenses are asserted.

Prior to the Oace invention, great difficulties with conventional methods of splicing electric conductors had been encountered, among others, the bulky and cumbersome and time consuming element in making splices; the materials available were ineffective under temperature changes of heat and moisture; the loss of tackiness (adhesiveness) and by becoming soft and pasty, resulting, in the tape then in use, in loosening and becoming ineffective. Slight increases in temperature above normal room temperature increased this tendency to impair the effectiveness of the splicing

material with the consequent grave hazards of escaping voltage.

The Oace invention overcame these and other defects by providing an insulated spliced electrical conductor which is "electrically, mechanically and chemically effective" and is readily and quickly prepared without use of special procedures or equipment. These results were obtained by the use of an insulating tape in the form of a relatively thick but easily stretchable and highly elastic pressure-sensitive adhesive tape comprising a well-bonded, water-insoluble, non-corrosive, normally tacky and pressure-sensitive adhesive coating on a plasticized vinyl chloride polymer film which is in permanent equilibrium with the adhesive; it neither softens nor loses its adhering qualities on prolonged contact with the backing or film layer.

Oace found that high molecular weight modifier such as "Paraplex G-25" would produce the desired strength, stretch and elasticity in vinyl chloride polymer films, though classed as "non migrating" or "permanent" plasticizers, failed to provide for permanent equilibrium of adhesive and backing. When tape made in that manner was unwound from the roll, after a moderate period of storage it would not adhere either to the electrical conductor or to its own backing, and was of no value as an insulating and protective coating. Oace provided an electrical insulating tape having stretch and elasticity rendering it highly effective for wrapping wire and cable splices. It was stretchable to the extent of 50% at room temperature, by mere pulling with the hands; it could be stretched 30% at room temperature and would retract to substantially its original length. He discovered how to overcome moisture and temperature destruction and to prevent loss of adhesiveness due to migration. He gave examples of insulating tapes in the form of pressure-sensitive adhesive tapes having a vinyl polymer film base prepared with a vinyl chloride vinyl

acetate copolymer softening at about 280 degrees F. and in the ratio of vinyl chloride to vinyl acetates of approximately 89:11. After giving many examples, he finds that the plasticizer must be compatible with the vinyl polymer, and must be sufficiently low in volatility so that it is not driven off during milling and calendering, or during subsequent storage and use.

After citing five examples of the various embodiments of his invention, for purposes of illustration rather than limitation, he makes the five claims set out in the margin.[1]

---

1. 1. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprised of: a stretchable and elastic film backing having a thickness of 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of a film-forming polymer of monomers including at least a major proportion of vinyl chloride, a substantially non-volatile liquid phthalyl ester plasticizer amounting to 8 to 20 parts per 100 parts of said polymer, and a soft and viscous low-acid number alkyd plasticizer resin in amount at least equal to the amount of said liquid phthalyl ester plasticizer, the total amount of said plasticizers about being ⅓ to ½ the amount of said polymer and the proportions being such that the adhesive tape has the properties of stretch and elasticity hereafter specified without causing pastiness or tack-loss of the contracting adhesive in the roll; and a eucohesive normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing; said adhesive tape being unwindable without delamination or offsetting of adhesive, being originally stretchable by hand-pulling to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30% as herein specified.

2. An adhesive tape according to claim 1, wherein the adhesive includes a small proportion of an oil-soluble heat-reactive phenol-aldehyde resin.

3. An adhesive tape according to claim 1 in which the film forming polymer is a copolymer of vinyl chloride and a minor proportion of vinyl acetate, said copolymer having a softening temperature of at least about 280 degrees C.

4. A pressure sensitive adhesive insulating tape wound upon itself in roll form and comprised of: (1) a stretchable and elastic film backing having a thickness of 4 to 10 mils and formed of a homogeneous mixture primarily consisting of a stable blend of

The reissue copies all contained in the original patent, and adds claims 6, 7, 8, and 9 to the five of the original patent. Claim 6 typical of the others is cited in the margin.[2]

---

70 parts of a copolymer of vinyl chloride and a minor proportion of vinyl acetate, about 10 parts of a substantially non-volatile liquid phthalyl ester plasticizer, and about 20 parts of a soft and viscous low-acid-number alkyd plasticizer resin; (2) an adhesive primer coating on the inside face of the film backing adapted to increase the anchorage of the adhesive coating; and (3) a eucohesive normally tacky and pressure sensitive rubber-resin type adhesive coating bonded to said primer coating; and said adhesive tape being unwindable without delamination or offsetting of adhesive being originally stretchable to an extent of at least 100% at room temperature and being substantially completely retractable from an elongation of 30% as herein specified.

5. An adhesive tape according to claim 4, wherein the adhesive includes a small proportion of an oil-soluble heat-reactive phenol-aldehyde resin.

2. 6. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprising: (1) a water-insoluble and hydrocarbon-oil-insoluble film backing of high dielectric strength containing a stabilizer and having a thickness of 4-20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of (a) a film-forming polymer of monomers including at least a major proportion of vinyl chloride, and (b) a substantially non-volatile plasticizing material therefor in an amount within the range of at least ⅓ the weight of said polymer but in a substantially lesser amount than said polymer and comprising at least a major proportion of a non-migrating viscous plasticizer resin, and the proportions being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contracting adhesive in the roll; (2) an adhesive primer coating on the inner face of the film backing adapted to increase the anchorage of the adhesive coating; and (3) a water-insoluble normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing, over said primer coating, said adhesive coating being thin in relation to said film backing; said film backing being in permanent equilibrium to said pressure-sensitive adhesive coating so as to avoid pastiness or loss of tack of the said adhesive coating and diminution of the flexibility of said film backing; said adhesive tape being unwindable from the roll without delamination of the tape or

The specification of the reissue is the same as the original patent except comment on the novelty of the tape and definition of terms. There are no additional disclosures of a tape or how to make it. The claims of the reissue appear to embody nothing not disclosed in the original application and invention and they do not broaden the disclosures of the original patent that are further descriptive or illustrative of the teachings of the original patent. The recent case in the Fourth Circuit of Florence-Mayo Nuway Co. v. Hardy, 168 F.2d 778, appears to state the principles of law applicable to the instant case. Applying the principles of law so ably stated by Judge Parker in Colgate-Palmolive Co. v. Carter Products, Inc., 4 Cir., 230 F.2d 855, to the facts in this case, we conclude that the patent is valid. The instant case and the Palmolive case above are not in conflict with the opinion in Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 S.Ct. 1143, 89 L.Ed. 1644.

Much of the controversy here arises from the employment of Paraplex G-25 as one of the ingredients in the production of the tape by the plaintiff and by the defendants in the accused tapes.

It is perfectly clear that the Paraplex G-25, when the application for the original patent was filed, was of a substantially different formula than that of its later or subsequent vintage. This old formula of Paraplex G-25, in part, accounted for the defects of the tape which became manifest from the exposure, change of moisture or temperature or

---

offsetting of the adhesive, being originally stretchable in widths not greater than about one inch by simple hand pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30%, as herein specified; said tape being readily conformable to irregular surfaces in insulating wire splices and its elasticity, retractability and high adhesion value making it easy, in insulated splices, to produce snug wrappings and coverings, and said tape having sufficiently aggressive adhesiveness to remain tightly and snugly wrapped around splices and wires.

from storage. The problem was to discover what to do to solve these difficulties. Oace discovered and taught how Paraplex G-25 could not be used alone but the combinations with it which would add to the equilibrium of the tape and vastly prolong its usefulness and efficiency, and how to eliminate migration. The evidence abundantly shows that the subsequent vintage of Paraplex G-25 was altered and tailored so that, in a large measure, it overcame the migration. But the alteration of Paraplex G-25 which in its new vintage included the old vintage of Paraplex G-25 and the chemical product which plaintiffs discovered necessary to use in combination to solve the problem, does not invalidate the patent or excuse the defendants from infringement.

If it be granted that there was novelty in the chemical combination which resulted in a non-migrating adhesive tape which was resistant to changes of heat and moisture and storage, and if we conclude, as the evidence shows, that such a solution was discovered by using dioctyl phthalate or other plasticizer compatable with vinyl polymer and with a definite ratio which was sufficiently low in volatility so that it was not driven off during milling, storage or from exposure; and the desired film could be produced from a mixture of 700 parts of Vinylite VYNS, 200 parts of Paraplex G-25, 100 parts of dioctyl phthalate and 25 parts calcium stearate milled together and calendered to a thickness of 4 mils; to which was added a primer made of 965 lbs. of an ammoniacal casein with 624 lbs. of an aqueous dispersion containing 38% by weight of a copolymer of 50 parts butadiene and 50 parts styrene after drying resulted in an extremely thin primer film then add to the primed film the mixture of properly apportioned elements constituting the pressure-sensitive adhesive, the three elements —film, primer and adhesive—, resulting in the new combination for making the desired tape as is taught in the Oace Patent, then it is obvious that a subsequent alteration

of some of these elements, for example, by including two of them into one element, and thereafter using the result, could not invalidate the patent nor successfully avoid infringement. Judge L. Hand in Royal Typewriter Co. v. Remington Rand, 2 Cir., 168 F.2d 691, 693, tersely stated the principle in these words: "Courts have with curious unanimity held that it does not avoid infringement to combine into one member that which the patent discloses as two, if the single member performs the duties of both in the same way."

The accused tapes clearly infringe claims 1 of the original patent and 6 of the Re-issue. Not only are the accused tapes the equivalent of the tape embodied in the above claims but they are practically identical in result. Moreover, they actually embody the very chemical equivalents taught in both the original patent and in the Re-issue. It is significant that Plymouth discounted the value and marketability of plaintiff's product until it became the leader in the electric tape field. Plymouth's salesman discovered this and afterwards Plymouth came out with the accused tapes. In August, 1947, General Electric, speaking of No. 33 Scotch electrical tape (under Oace Patent), said: "For the first time in fifty years a revolutionary electrical tape is on the market ready for immediate delivery."

The commercial success of the patented tape was phenominal. In 1945 t[illegible] sales were $8,270.19; in 1946, $94,000; in 1948, $1,500,000 and in 1953 reached $8,712,744.75. When Plymouth copied Oace Patent, its sales jumped rapidly to $400,000 in 1952 and $500,000 in 1953. In 1950 and 1951, Plymouth's output was so small it did not bother to get the figures.

A decree will be entered permanently enjoining each defendant from further infringement and appointing Rufus Reynolds, Esq., to ascertain the damages.

Excerpts from Discovery Depositions of Louis Klein, E. M. Beavers, Arthur L. Blount and John Myers, Taken by Defendant at Philadelphia, March 22-23, 1955.

Deposition of LOUIS KLEIN, witness called by defendant, Vice-President in charge of sales of Resonance Products Division, Rohm & Haas Company:

Direct Examination.

. . . . . .

[4] Q5. In this case there has been mentioned from time to time a certain plasticizer called Paraplex G-25. Are you familiar with that plasticizer? A. Yes, I certainly know about it. It was an im- [5] portant product in the Resinous Products & Chemical Company.

. . . . . .

[8] Q18. Now, Mr. Klein, was there any, shall we say, principal use of this plasticizer almost at the outset of your manufacture thereof? [9] A. Yes. I don't recall the early history of AR-148 as such when the product was known under that designation, but in the case of Paraplex G-25, the first important commercial use was in a vinyl sheathing for specialized electrical application.

Q19. That was the government use on the polyethylene cable? A. It was the government use on the polyethylene cable.

. . . . . .

Q22. That was the so-called coax radar cable, in which the government was interested at that time? A. The radar cable is what we knew it as. I recall that so well because it was such an important use, because there was an important problem to solve and this solved it.

Q23. A vital government need at that time? A. Very vital.

. . . . . .

[39] Q104. I call your attention to the letter of October 26, 1943 and ask you if it does not consider the use of AR-148, that is, G-25, in connection with a monomeric [40] plasticizer. A. This letter of October 26, 1943 says that we were at that time planning to consider the use of Paraplex AR-148 (G-25) together with an ester-type plasticizer, and by that we meant monomeric.

Q105. A monomeric plasticizer? A. Monomeric plasticizer.

. . . . . .

[66] Q155. Returning again to Defendants' Exhibit 24 for identification, and particularly the last paragraph on numbered page 2 thereof, under the heading "Paraplex G-25,"—do you have a copy in front of you? A. Yes.

Q156. Do you there find a reference to the use of Paraplex G-25 with other plasticizers as a general statement? A. I interpret this paragraph to mean that in commercial practice it is customary to use more than one plasticizer with the vinyl resins, meaning that is what is customarily used—not that it is necessary to use more than one plasticizer.

. . . . . .

Cross-Examination.

[72] XQ180. Yes, I see. But there are some differences in [73] molecular weight or viscosity between Paraplex G-20 and Paraplex G-25, are there not? A. Well, there is in our opinion a real difference in the nature of G-25 and G-20. We characterize G-25 as a linear polyester. Paraplex G-20 is not a linear polyester.

. . . . . .

[90] XQ238. Do you know what G-20 was sold and produced for during the early thirties, the '30 to '35 period? A. Yes, sir, I do.

XQ239. And the major thing was what? I mean, the [91] general type of use. A. Well, plasticizing nitrocellulose.

. . . . . .

[92] XQ247. That isn't quite my question, Mr. Klein. I am not suggesting that you pushed it for that purpose. My question was whether you mean your testimony to be that your company had Paraplex G-20 on the market from 1929 to 1944 without even realizing that it was compatible with vinyl chloride polymers. A. Well, I don't know how to answer that question. Just in my mind it doesn't stick that Paraplex G-20 was commercially useful with vinyl chloride copolymers.

XQ248. Is it today useful with vinyl chloride copolymers? [93] A. Not to my knowledge.

. . . . . .

[129] XQ376. Is G-25 chemically the same material today as when it was first offered commercially by your company? A. To the best of my knowledge it is.

XQ377. Is G-20 the same today as when it was first offered commercially? A. Again, to the best of my knowledge it is.

. . . . . .

[141] XQ419. Now, as G-25 was first put on the market did it [142] contain some monomers and dimers along with polymers? A. Not to the best of my knowledge.

XQ420. Did you make any efforts to remove the monomers or dimers? A. Oh, yes. That was a very careful processing step to do that.

XQ421. And you felt that you got—tell us what you know about how well you succeeded in getting the monomers and dimers out. A. Well, again I think you are asking the wrong man the question, but I can say that just in a general

sort of way that we used a high-vacuum technique and a very critical part of the operation is the removal of low molecular weight materials along with excess glycols. We have always considered it a truly polymeric material. That is why we talk about non-migratability and so forth."

. . . . . .

Deposition of E. M. BEAVERS, witness called by defendant, Laboratory Head of Research Department of Rohm & Haas Company:

Direct Examination.

. . . . . .

[160] Q27. What do you say as to the last sentence on page 1 of the letter? Can you verify that of your own knowledge, if you have such knowledge? A. Oh, yes, I would verify that statement.

Q28. And that is the statement that reads:

"In each of these products no significant change has been made since it was first offered for sale."

And that follows a reference to Paraplex G-25 and G-40, among others. A. (Witness nods head.)

. . . . . .

[165] Q54. What was the reason for the development of G-40, since you already had G-25? Or what were the reasons? [166] A. I think we had two primary reasons for developing G-40. One was that it was lower in cost than G-25. The other was that it was less soluble in hydrocarbon solvents. We thought this might be of some value.

. . . . . .

[167] Q61. And there was and always has been a cost differential between G-25 and G-40, is that not correct? A. Yes, sir, that is correct.

Q62. And a substantial one? A. An important one, yes, sir.

. . . . . .

[180] Q97-½. Is G-20 a suitable plasticizer for VYNW and VYNS A. No, sir, not that I know of. We have tested G-20 at the 35-per-cent level with VYNW and it was not compatible on the mill. But this statement says "and its copolymers." And the copolymers I have in mind are Vinylite VAGH, for example, with which G-20 is compatible.

Q98. Or VYHH? A. Or VYHH to some extent.

Q99. So that for the high molecular weight VYNW and VYNS, the G-20, as you say, would not be a suitable plasticizer? A. To the extent that we have tested it, that was our conclusion.

. . . . . .

[182] Q103. You certainly don't recommend G-20, that is, for use with VYNW or VYNS? A. Not that I know of.

. . . . . .

Q104. Have you ever recommended it to your knowledge for use for those two specific PVC acetate copolymers, namely, VYNW and VYNS? A. Not to my knowledge.

. . . . . .

[190] A. The vacuum stage of the process for the preparation of G-25 has as the purpose the removal of free glycol and water which may result from the polyesterification.

. . . . . .

Q114. Is that conducted at a temperature which tends to remove lower molecular weight material? Are the conditions such that it tends to remove lower molecular weight material? A. I am afraid that in order to answer

that I would have to know how low you mean. That is a matter of interpretation, it seems to me.

Q115. Well, suppose we say material of the order of three, four, 500 molecular weight. A. I don't know that it would remove anything that high in molecular weight.

Q116. Is whatever you have said as to G-25 also true of G-40? A. Yes, sir.

Q117. So whatever is true of one would be true of the other? [191] A. Yes, sir.

Q118. In that respect. Do you regard G-25 as a truly polymeric material? A. In the sense that the polymer chemist usually has in mind, yes, indeed; it is a truly polymeric ester.

Q119. And the same is true of G-40, of course? A. Yes, sir.

. . . . . .

[230] RXQ283. Now, the next paragraph here says:

> "As a group, the Paraplex resins are soft, flexible resins widely used as plasticizers for more brittle film-forming materials such as nitrocellulose, ethyl cellulose, polyvinyl chloride and polyvinyl butyral."

Do you agree with that statement? A. I can think of exceptions to that statement, and I think that statement is not absolutely and broadly applicable if you interpret it literally.

RXQ284. Is it a fair general statement? I understand it to be offered as a general statement. A. It is a general statement which has specific exceptions, yes, sir. It is intended to indicate in a general way that Paraplex resins act as plasticizers. If you come down to particular cases, then you would have to make some exceptions. Paraplex G-20, for example, we were not able to incorporate into VYNW at the 35 per cent level and yet VYNW is a polyvinyl chloride and G-20 is a Paraplex.

RXQ285. Yes. But you are not saying that you were not [231] able to incorporate it at any level, are you? A. I cannot say that, no.

RXQ286. Now, there is a limit to how far you can incorporate G-25 and G-40, is there not, in certain types of these synthetics? They aren't compatible in all proportions, are they? A. I don't know of any limit to the compatibility of G-25 with polyvinyl chloride.

. . . . . .

Deposition of ARTHUR L. BLOUNT, witness called by defendant, Assistant Plant Manager of Resonance Products Division, Rohm & Haas Company:

Direct Examination.

. . . . . .

[241] Q14. Have you manufactured on a plant production basis [242] G-25 ever since you began in April of 1944, as you stated? A. Yes.

. . . . . .

[243] Q23. Now, Mr. John F. Bergin sent attorneys for both [244] parties herein a letter of December 29, 1954, here identified as Defendants' Exhibit 13, which I hand you and ask if you can confirm—

. . . . . .

[245] A. Well, again I can only speak for G-25 at the moment. I haven't reviewed my information on G-40, 50 or 53. I know that there is no significant change in the product in the case of G-25, since its manufacture.

. . . . . .

[247] Q29. Do you say that there was no significant change in the product? A. I said I know of no significant

change in the product since we started the manufacture of it.

Q30. Did the data studied indicate that there was no significant change? A. Of course the only way by which I can pass upon the quality of the product is by reference to the specifications which define the material, and within the specifications that we have established for this material, all the production that we sold complied with those specifications. Now, that is what I mean.

Q31. And do you work closely to those specifications? A. We work very closely with them. In all instances we work closely with the specifications.

. . . . . .

[248] Q34. Is it true that at some late stage of the manufacture of both G-25 and G-40 you have stripped the volatile materials by a high temperature and high vacuum distillation?

. . . . . .

A. I will say yes.

. . . . . .

[249] Q35. Can you tell us if such distillation has continued over some period of time? A. It has, a considerable period of time.

. . . . . .

Q37. Are the time, temperature and vacuum factors calculated to strip the volatile materials by such treatment? A. Well, I could avoid that question by saying that I am not the chemist or the man that developed it, as far as I am concerned. I would have to express an opinion and you don't want opinions.

Q38. Well give that opinion. A. My opinion is yes, that the time and the temperature at which we strip these are sufficient to strip off any volatile material other than the product we are trying to manufacture.

[259] Q39. And you meant to include the vacuum factor, too? A. Yes I did.

. . . . . .

Deposition of JOHN MYERS, witness called by defendant, Manager of Sales Development Department, Resonance Products Division, Rohm & Haas Company:

Direct Examination.

. . . . . .

[259] Q32. Was there some one principal use very early in the history of Paraplex AR-148 and G-25? A. Yes, sir.

Q33. What was that? Tell us briefly. A. As a plasticizer for vinyl used in a cable jacket on high frequency cables.

. . . . . .

Q36. Did you people approach them in the first instance? A. Did we approach the Navy?

Q37. Yes, sir. A. No, they approached us.

Q38. Seeking what? [260] A. Seeking a plasticizer which would do this particular job.

Q39. What was the particular job? A. To give a non-migrating plasticizer for polyvinyl chloride that wouldn't migrate into polyethylene when used as a cable jacket.

. . . . . .

Q44. As a matter of fact, that job gave the product considerable impetus, did it not,— A. Yes, sir.

Q45. —in non-migratory applications? A. It gave it a considerable impetus as a plasticizer for vinyl, at least.

Q46. And you used all of the sales promotion energies you could command to sell the product as a non-migratory— A. We hope the management felt that way.

. . . . . .

[278] Q130. Have you any knowledge as to the curve of sales, so to speak, for G-25 in 1944? A. Not the specific figures. I remember that as a result of this coaxial cable development it developed much faster than we had ever anticipated. What the level was, actually, I don't remember.

Q131. That really gave you the big leg up in the business? A. Yes, sir.

. . . . . .

[314] Mr. Kirkpatrick: Mr. Bergin, you wish to say something concerning Mr. Blount?

Mr. Bergin: I have talked to Mr. Blount by telephone this morning and he tells me there has been no significant change in the composition of Paraplex G-40 since the time it was first manufactured in the plant.

Mr. Kinney: Based on our discussion of yesterday, Mr. Kirkpatrick, we are willing to agree, to [315] save Mr. Blount coming back, that if he were called as a witness he would so testify.

. . . . . .

Excerpts from Deposition of Irving C. Eaton, Taken by Defendant at Bridgeport, Connecticut, April 7, 1955.

Deposition of Irving C. Eaton, witness for defendant, employee of General Electric since 1925, at Bridgeport plant since 1930, and now Consultant, Construction Materials Laboratory:

Direct Examination.

. . . . . .

[3] Q. Did General Electric, to your knowledge, ever manufacture at Bridgeport so-called coaxial electric cable?

A. Yes, we most certainly did, beginning in the early part of World War II.

Q. For what was that used? A. Well, it was used principally for high frequency cable, radar and similar applications.

Q. Was any improvement made in the early part of World War II, particularly a change in insulation? A. Yes. Very fortunately, [4] there was a development by the British, developing polyethylene, which was found to be a very much better insulating media than materials which were used prior to that time.

Q. Will you tell us, generally, the structure or make-up of the coaxial cable? A. Well, in simplest form, you had a conductor, over which was polyethylene insulation, and over that a metallic braid, and over that a protecting thermoplastic sheath material.

Q. What was the material of that plastic sheath? A. Well, it is a polyvinyl chloride composition, plasticized polyvinyl chloride.

. . . . . .

Q. Did you have trouble with this polyethylene when you used it? A. We did have in the early days, principally for the reason that this protective sheath that I have talked about was of such a composition and character that there were migratory conditions, where the plasticizer in the sheath migrated into the polyethylene and "poisoned", as we call it, the polyethylene.

. . . . . .

[5] Q. (By Mr. LeGates) And did you not know that this deterioration which you found by test was due to movement of material from the jacket into the polyethylene? A. Well, we had a composite. We had a construction which involved the use of material which was known to be very good electrically, very low electrical losses, and it was

known that if there would be any great migration, then the electrical characteristics of that underlying insulation would be affected.

. . . . . .

[7] Q. Your work at G.E. at that time required you to know and have familiarity with insulating materials, is that correct? A. That's right.

Q. And with synthetic resinous insulating materials? A. Yes, that is what we were dealing with in this case.

Q. And with plasticizers, used as such? A. Yes. This sheath material which we were using was a type of material which involved the use of a resin—in this case it was polyvinyl chloride—and a plasticizing material, or a plasticizer.

Q. Was the problem of deterioration a matter of concern to the armed forces? A. It was of very great concern to them, for the reason that types of protective sheath material involving the use of migratory types of plasticizers would not do the job.

[8] Q. What did they do to attack this problem? A. Well, the job was tackled pretty much on a nationwide basis. The problem was so important that this thing was tackled pretty much on an industry-wide basis, and the best brains in the business were gotten together to try to solve it.

Q. They were gotten together at meetings? A. Yes.

. . . . . .

Q. What was the solution? A. The solution was the development of a plasticizer which was much less migratory than others which [9] had been used before that time.

Q. What was that? A. This was a material by The Resinous Products Company, which the company called G-25.

Q. Also known as Paraplex G-25? A. Yes, Paraplex.

. . . . . .

Q. When did this occur? A. Well, starting in around 1942, if I remember correctly, and for the balance of the war period.

Q. Was this Paraplex G-25 you have mentioned actually used in the radar cable? A. Yes.

Q. When was that? A. Well, G-25 is still used.

Q. Let me ask you a further question: Was it used promptly after it was brought to light? A. You bet it was, because we had a problem, and G-25 seemed to be the solution to the problem. Therefore, we and others in the business of making high frequency cables went right into the use of G-25.

. . . . . .

Cross-Examination.

. . . . . .

[21] XQ. Well, the losses in electrical energy at high frequencies, measured in decibels, would be some measure of the attenuation value of the insulation? Do I state it correctly, or am I all mixed up on that? A. I think perhaps I would only care to go as far as to say that we were dealing with material wherein electrical losses, of necessity, are to be kept down to a minimum. And the older type of plasticizing material for polyvinyl chloride involved electrical [22] poisoning, as we have termed it. In other words, the plasticizer was of such a nature that it migrated into the insulating material and poisoned it, so-called, and made for higher electrical losses in that insulation.

Therefore, when we were able to get a plasticizer which was less migratory than the older types, there was a very definite gain made. In other words, there was a real contribution made by the Resinous Products people, to the end that you had a better, a more certain insulating material for operation at high frequencies.

. . . . . .

Excerpts from Deposition of Paul Shalita, Taken by Plaintiff in New York, April 20, 1955.

Deposition of PAUL SHALITA, witness for plaintiff, Technical Director and Vice-President of Technical Tape Corporation:

Direct Examination.

. . . . . .

[5-6] Q. Do you know when your company first made and sold a pressure-sensitive vinyl plastic electrical tape? A. It was made first in late 1949 or the first month or so of 1950, and sold approximately in that same period.

. . . . . .

[91] Q. I believe you testified there was some difficulty experienced in making tape with these films; you ran into some difficulties, is that correct? A. I think I testified that on the VUWB 59402, that there was some difficulty until we got the proper adhesive formulation for it.

. . . . . .

[92] Q. Has it been your experience, Mr. Shalita, in making a vinyl plastic electrical insulating tape with a vinyl film backing and some kind of a plasticizer, that one may satisfactorily use any kind of pressure-sensitive adhesive on it? A. No. It's been my general feeling that a specific adhesive had to be formulated for a given film.

Q. Does that depend on the composition of the film in terms of the nature of the resin and the type and amount of plasticizers and type and characteristics of the pressure-sensitive adhesive? A. Yes. I think they all play a part in producing a functionable pressure-sensitive tape.

. . . . . .

[93] Q. Now, in the commercial manufacture of "Tuck" brand vinyl electric tape, has Technical Tape Corporation used any of the specific adhesive formulations disclosed in the Oace patent? A. I think I have already testified it has not.

Defendants' Exhibit 60A.

Swiss Patent No. 206,871
Class 125b

Published December 1, 1939

Application Received February 6, 1939--6:15 P.M.
Patent Entered August 31, 1939
(Priority: Germany, January 5, 1939)

Wilhelm Bierbrauer, Zürich (Switzerland)

Adhesive Tape for the Respective Sealing and Unmasking of Protuberant, Angular or Otherwise Uneven Surfaces

Adhesive films with self-adhering adhesive are well-known with a base of woven material (cotton, wool, rayon, etc.) or from creped paper for applications for technical purposes. Used for example for the closure of boxes (cans), they have the disadvantage that they do not stop air and moisture, a property which is caused by the porosity of such materials.

Films from synthetic material also coated with adhesives are also known: for example cellophane or waxed and coated papers. These films, however, are neither stretchable nor elastic. To be sure, on flat surfaces, they shut out air and water but where protuberances or corners have to be adhered, they are not effective. Thus, they can not be effectively attached on account of their insufficient stretchability and elasticity to articles which have protuberances, hollows, or angles, as for example rectangular boxes (cans).

Thus, these adhesive films are not effective barriers in all cases where it is necessary to shut out air and water.

Finally, there are adhesive films from chlorinated rubber and rubber and wax mixes. These films are air and water tight and to some extent stretch, but they have only slight elasticity and show the additional disadvantage that

they can easily be overstretched, that is by overpulling, they lose continuity in particular spots. Adhesive tapes under this invention obviate these disadvantages by being made from air and water tight deformable, permanently elastic, synthetic films which are coated with a self-adhering, latex-resin mixture.

The above invention rests on the realization that there are certain plastic materials which fulfill all these requirements for air and water tightness, deformability, and elasticity. By deformability, we here understand the property that a material has, when stretched to twice its original length, of losing none of its mechanical strength, that is resistance against tearing, from the unstretched material; and by elasticity, it is understood that the property is not lost, of returning spontaneously to its original dimension upon release of the stretching force. These properties appear in the mixed polymers, for example the vinyl resins which appear in the trade under the trade-name "Mipolam" or in acrylic acid esters which appear in the trade under the name "Flexigum". These films can be treated with self-adhering materials from unvulcanized or slightly vulcanized latex with which resin is mixed and retain their self-adhering properties practically undiminished without any influence on the base material by the adhesive.

The new adhesive tapes unite the deformability and elasticity of adhesive films on woven base with the air and water impermeability of films on a stiff synthetic base, in that they are very tear resistant and as a practical matter cannot be overstretched.

On account of these new unexpected, favorable properties, the new adhesive tapes are not only indicated for closing bottles, boxes (cans), ointment cans, and similar containers which have rounded or angled edges, but also they are very useful for other technical purposes where it is desirable to protect irregular or angular edges during

lacquering operations, as for example in airplane or automobile manufacture.

For these purposes, one can lay down such adhesive films in slightly stretched condition whereby on account of their elasticity, they hold tightly and surround the adhered object with a completely strong water impermeable and air impermeable layer.

Patent Claim:

Adhesive tape for the covering of curves, angles, or other uneven surfaces comprised of an air and water impermeable, extensible elastic plastic film which is covered with a self-adhering, latex-resin adhesive.

Sub Claims:

1. Adhesive tape according to the above claim in which the plastic is a mixed polymer.
2. Synthetic tape according to the above claim in which the synthetic polymer is a mixed polymer of vinyl resin.
3. Adhesive tape according to the claim in which the plastic is an acrylic ester polymer.

Excerpts from Discovery Deposition of R. W. Lundbohm, Taken by Defendant at Boston, Massachusetts, June 9, 1955.

Deposition of R. W. Lundbohm, witness called by defendant, employee of Minnesota Mining & Manufacturing Company for ten years as a chemist in the Tape Laboratory:

Direct Examination.

. . . . . .

[4] Q9. And I assume from that that it is the custom for Minnesota, and has been during your time, to analyze competitors' tapes periodically? A. Yes, sir.

. . . . . .

Q11. And those competitors' tapes that you have analyzed include plastic electric tape presumably made by Plymouth Rubber Company, is that not so? A. Yes, sir.

. . . . . .

[14] Q66. I will pass by the next document, which seems to be of [15] no significance. Now we next come, Mr. Lundbohm, to "Analytical Test Report-Tape Department-AR-1086," dated May 28, 1951, and bearing at the end your name, R. W. Lundbohm, is that not correct? A. Yes, sir.

Q67. The subject of this test report was "Competitive Plastic Electric Tapes," is that not so? A. Yes, sir.

Q68. Then you have a paragraph entitled "Background." It states, "Quantitative and qualitative analysis of the plasticizers being used by competitors in the plastic electric tape field has been requested relative to the claims which the Patent Office has allowed 3M." 3M is your designation for Minnesota, I take it? A. Yes, sir.

. . . . . .

Q70. Now the next paragraph is entitled "Analyses." It states in substance that extractions from the backing, free from adhesive, were performed in Soxhlet extractors and that the composition of each extract was ascertained by comparative infrared absorption spectra run by Central Analytical Research. Now by samples you mean samples of the plasticizer, is that not so? A. Yes, sir.

. . . . . .

[16] Q72. From which they can determine the character of the plasticizer, is that so? A. Yes, sir.

. . . . . .

[18] Q81. Now at the bottom are three samples entitled "3M Co.—Control Samples." Those, I take it, are samples of Minnesota commercial plastic electric tapes analyzed

for comparative purposes, is that correct? A. The three with the number 33 are Minnesota tapes, yes, sir.

Q82. Now the first tape of the ten competitors' tapes states that the type of plasticizer was "polyester and phosphate." Now phosphate indicates that there was some monomeric plasticizer together with the polyester? A. That is correct.

Q83. And all the other nine show that the plasticizer was polyester, is that correct? A. Yes, sir.

. . . . . .

Q85. Now the three control samples all have a plasticizer comprising a combination of polyester and phthalate, is that not so? A. Yes, sir.

. . . . . .

[20] Q93. Now, Mr. Lundbohm, Mr. Kinney sent us also some copies—

Mr. HOLMES. I take it these are copies, Mr. Kinney, and not originals?

Mr. KINNEY. Yes. It is my understanding that they are copies.

Q94. —of what might be termed infrared tracings, among others, the one which I have in my hand and which I will show you in a little while. In the upper right-hand corner is a stamp "Central Research Laboratory—Test No. 6980, Date 5/10/51. Sample Plasticizer, Plymouth elect. tape. Origin Lundbohm." Is that not correct? A. Everything that you read is correct.

. . . . . .

Q97. Was it on the basis of this tracing, this infrared tracing that you recorded in the test report, Defendants' Exhibit 58-F, [21] Report No. AR-1086, that the plasticizer of the Plymouth Rubber Company sample, TSC-2754, was "polyester"? A. Yes, sir. It was on the basis of infor-

mation furnished us by the Central Analytical Research Laboratory that we made this entry on AR-1086.

Mr. HOLMES. I will have this infrared tracing marked Defendants' Exhibit 58-G for identification.

[Infrared tracing marked "Defendants' Exhibit 58-G for identification."]

Q98. Written in longhand on the body of the tracing are the words "All Paraplex G-40," as you will note? A. I see that notation, yes, sir.

. . . . . .

[22] Q103. There are records earlier than May of 1951 of tests of competitors' tapes which are not included in this file? A. I don't know that.

Q104. Have you made any effort to ascertain that? A. I haven't made that effort.

. . . . . .

[32] Q140. Now, Mr. Lundbohm, at the bottom of the page of Defendants' Exhibit 58-F for identification, page 1, and at the top of page 2, there is a substantial obliteration. Now did the matter which is here obliterated have reference to patent claims in any way? A. I can answer that very easily. I don't have any idea what was obliterated. I would have to go back to the original sheet to see that.

. . . . . .

Q143. Would it be your custom in submitting a test report of this character to make any comment as to what is recorded? A. It would not be our custom to comment on it.

Q144. I note in your report of November 9, 1950, being Exhibit 58-C, following the description of the adhesive backing and the primer, there is a paragraph entitled

"Discussion." Now in that report you did follow the description of what you found by some comments, is that not so? A. Yes, sir.

. . . . . .

[35] Mr. HOLMES. Now, Mr. Kinney, I asked you to bring with you the original of the analytical test report, Defendants' Exhibit 58-F of May 28, 1951, and indeed all obliterated documents, so that if it appear that we are entitled to see the obliterations, what is obliterated, or at least for the purpose of determining whether it was material properly obliterated. Now have you done so?

Mr. KINNEY. No, sir.

Mr. HOLMES. Do you know what was obliterated?

Mr. KINNEY. I don't know now. I could certainly very easily find out.

. . . . . .

[37] . . . Now you made claim—I have specific reference to the obliterations at the bottom of page 1 and the top of page 2 on Defendants' Exhibit 58-F—that the material obliterated was of a "confidential nature." Might I ask if that material had reference to or was concerned with any trade secret of Minnesota of any character, business character or technical character? May I ask that question?

Mr. KINNEY. You certainly may ask the question, Mr. Holmes, but I'm in no position to give you an answer.

. . . . . .

[39] Q155. Mr. Lundbohm, so that you may refresh your recollection or determine the nature of the obliterated material on Defendants' Exhibit 58-F for identification—and I would not be asking you at this time necessarily to state exactly [40] what the language is—will you take Mr. Kinney's copy which has tape on the obliterations and see if you can't peel that off to disclose the material underneath

so that you can then tell me the general nature of the obliterated material? A. I don't know if I would be permitted to do that.

. . . . . .

Mr. KINNEY. I certainly decline to give him these work papers.

. . . . . .

[*Proceedings before Judge Ford.*]

. . . . . .

[59] The WITNESS. I have no memory of what is beneath that tape. It will be as revealing to me as anyone. I have no memory of what is beneath there.

The COURT. I'm not too sure I believe you.

. . . . . .

[65] The COURT. Let me determine that. Is it your point that it is of a confidential nature?

Mr. KINNEY. Yes.

The COURT. That is a different point. Now if counsel will retire, I want to expedite this matter [66] as reasonably as possible, and my own law clerk will remain.

[At this point Mr. Holmes, Mr. Kirkpatrick, Mr. Lundbohm, Mr. Sheehan retired from the room for a period of fifteen minutes.]

The COURT. I have talked to Mr. Kinney about this matter and as a result of our discussion he has agreed to exhibit to you what is under the tape.

. . . . . .

The COURT. I don't know what it amounts to at all, but it doesn't seem to me to be involving a secret process.

. . . . . .

Excerpts from Discovery Depositions of Esther E. LeI'age, Warren D. Hurd, Ralph J. Oace and William E. Lundquist, Taken by Defendant at St. Paul, Minnesota, January 31–February 4, 1955.

Deposition of ESTHER E. LEPAGE, formerly Esther Eastwold, one of the patentees of the Oace *et al.* patent in suit, and an employee of Plaintiff, as a chemist, from about June, 1943, to April, 1951:

Direct Examination.

. . . . . .

[11] Q. Is it also correct that Dr. Lundquist was a member of that group at that time when you went to work? A. At the time when I went to work, Dr. Lundquist was part of that group under Dr. Hendricks.

. . . . . .

[20] Q. What sort of plasticizers did you use at the outset of your work with the vinyl polymers? A. We used monomeric plasticizers and polymeric plasticizers, or high viscosity plasticizers and low viscosity plasticizers.

Q. Will you please name the plasticizers you used at the outset? [21] A. I couldn't remember that. In a program of this kind, you consider many materials, and we considered the monomeric plasticizers. We used dioctyl phthalate—

. . . . . .

Q. (By Mr. Kirkpatrick) You have named dioctyl phthalate as one of the plasticizers. Can you name any of the other plasticizers of that caliber that you employed? A. Well, as I recall, there were many. We tried—tricresyl phosphate was one. I'm sure that there are trade names which I cannot remember now.

Q. Would you refer to each of those as a low molecular weight and monomeric plasticizer? A. Yes, I would.

. . . . . .

[22] Q. Now, you referred to high molecular weight plasticizers. Which of those did you employ first? A. I cannot remember which one we used first.

Q. Can you name any of those? A. We did use a "Paraplex G-25".

. . . . . .

Q. Is it correct to say that you cannot now name any other high molecular weight plasticizer than the G-25 that you used at that time? I am talking about that time, meaning about a year after you came there as you stated. A. I cannot remember exactly when all this—we evaluated other polymer plasticizers. I cannot remember when that work [23] was started.

Q. Or what they were? A. Well, we arrived at a combination in this Paraplex G-25 and DOP that satisfied our requirements very nicely, and it was the best—we were concerned in making a good product.

Q. Can you recall the names of any other high molecular weight viscous resinous plasticizers that you employed other than G-25? A. I think there are other ones listed in the patent.

Q. But you cannot now recall their names? A. Well, I think that polyethyl acrylate is listed, is it not?

. . . . . .

[33] Q. When the use of G-25 was first suggested to you, was it suggested as a non-migratory resinous plasticizer? A. I think that's what it was claimed to be.

. . . . . .

[38] Q. Did you ever employ bodily pressure-sensitive adhesive coatings from other departments or divisions of

people at 3-M? A. I got the adhesive from other departments.

. . . . . .

[42] Q. Is it correct to say that you have no recollection of Dr. Lundquist telling you that if you used monomeric plasticizers only, the adhesive applied to the backings would go pasty? A. That was well known throughout the company and I'm sure throughout the industry.

. . . . . .

[137] Q. All right. Now, when it came to the matter of the question of a reissue,—who first raised that question with you? A. I can't exactly remember who it was that first raised it.

. . . . . .

Q. And how long was that after the issue of your original patent?

. . . . . .

[138] A. It was within the year following that.

Q. (By Mr. Kirkpatrick) Can you place it any more accurately than that? A. It was in the summertime, before that reissue application was filed.

Q. Do you mean the summer of '51 or summer of '52? A. The summer of '52.

. . . . . .

[139] Q. Can you recall more than one meeting? A. No.

Q. Where was such meeting held? A. In St. Paul.

Q. Where in St. Paul? A. In the hospital.

Q. You were in the hospital at that time? A. Yes.

. . . . . .

[152] "Question: Can an adhesive pressure-sensitive insulated tape with vinyl polymer film backing, having the properties described in your patent, be made with

satisfactory results using only a viscous, non-migrating plasticizer resin, or resins?"

A. You are asking me a question now of work that I have been away from for a long time. I am not sure what can be made now.

. . . . . .

Q. (By Mr. Kirkpatrick) Do you know the answer to the question?

. . . . . .

[153] A. I have to say I don't know.

. . . . . .

[155] "Question: Do you state anywhere in your patent that the use of a plasticizer (or plasticizers) in addition to resinous plasticizers is optional or permissive?"

A. I think that in claim No. 6 of the patent that it is optional whether you add the non-viscous plasticizer.

. . . . . .

Deposition of WARREN D. HUBB, employee of plaintiff, connected with Tape Laboratory from 1937 to early part of 1944:

Direct Examination.

. . . . . .

[186] Q. In an affidavit in this matter you have referred to certain work you did in connection with the making of stretchable pressure-sensitive tapes. Will you please state what that work was, what you did, the results, and so forth? A. Well, I did quite a bit of work and I can't remember it all just off-hand, without looking at the records, but it was

in the direction of developing a stretchable plastic tape to be used for binding the insoles of women's shoes, and the results were all poor.

. . . . . .

[189] Q. Now, you indicated that you had poor results. I have forgotten your exact language. What did you mean in that regard? A. Well, all my adhesives went pasty. They all softened up.

. . . . . .

Q. At any rate, migration was the accepted reason for the behavior of the adhesive in going pasty? [190] A. Yes.

. . . . . .

Deposition of RALPH J. OACE, one of the patentees of *Oabe et al.* patent in suit, an employee of plaintiff since January, 1937:

Direct Examination.

. . . . . .

[214] Q. (By Mr. Holmes) That's just reasoning, Mr. Oace. Did you know, or when did you know, or did you always know that there was some viscous, non-migrating, resinous plasticizer which when used alone could be successfully so used without loss of tack? A. I don't know when I actually heard, or how I heard. . . .

. . . . . .

[215] Q. (By Mr. Holmes) Well, did you learn or hear that before or after January, 1946 when you filed the original application? A. I really don't recall. I can't place it in that time —

. . . . . .

Deposition of WILLIAM E. LUNDQUIST, chemist in employ of plaintiff since spring of 1942:

Direct Examination.

. . . . . .

[220] Q. . . . You know, of course, that Esther Eastwold LePage has testified in this matter. Was she under you from the inception of her work with the 3-M Company? A. As I recall it, yes, sir.

. . . . . .

[226] Q. While you were with DuPont, did you have any experience in connection with patent applications, patents, and so forth? A. Yes.

Q. And continued to have, of course, with 3-M? A. Yes.

. . . . . .

[229] Q. (By Mr. Kirkpatrick) Have you any recollection or can you say when you first learned of Paraplex G-25? [230] A. Somewhere around the start of 1944.

. . . . . .

[233] Q. Is it correct to say that G-25 is a soft viscous, low acid number, alkyd plasticizer resin? A. Yes.

Q. Is the same true of G-40? A. Yes.

Q. And each is of high molecular weight? [234] A. For a plasticizer they are pretty high.

. . . . . .

[237] Q. Was this test of G-50 or G-53, whenever it was made, the first time you had obtained such results with a single resinous modifier or resinous plasticizer?

. . . . . .

Q. (By Mr. Kirkpatrick) Either made or supervised, Doctor. I don't necessarily mean that you did it with your own hands. A. I can't remember. I would guess no, but that's a guess. It's not reliable.

Q. Had you ever heard of that result being obtained by anybody else before you made such test? A. No.

. . . . . .

[240] Q. (By Mr. Kirkpatrick) The reissue patent refers to a "cucohesive normally tacky and pressure-sensitive rubber-resin type" of adhesive. Was that a standard adhesive with the 3-M in 1944? A. Yes. Before I be so rash, — the terminology was standard. Just exactly which adhesive — where are you referring?

MR. HOLMES: Well, in Claim 1.

A. (Continuing) Oh. The terminology is standard if it's in Claim 1, — yes.

Q. (By Mr. Kirkpatrick) And similarly, was a water insoluble normally tacky and pressure-sensitive rubber-resin type of adhesive a standard adhesive with the company in 1944? — that language coming from Claim 6. A. Under the subheading (3) there, you mean? — yes.

. . . . . .

[252] Q. Now, how about G-40? Was there any change in that as originally received? A. I am not aware of any change.

. . . . . .

[254] Q. Are some adhesive compositions more subject to migration than others? A. Oh, yes.

Q. Are some adhesive compositions more subject to loss of tack than others?

MR. KINNEY: In what connection, Mr. Kirkpatrick?

MR. KIRKPATRICK: In their use on vinyl-polymer backed tapes of the invention. And I meant, of course, the same in the preceding question.

MR. KINNEY: I just thought it might make the record a little more definite.

MR. KIRKPATRICK: Right.
A. Yes.

. . . . . .

Excerpts from Testimony at Trial.

HUBERT JAMES TIERNEY, witness on behalf of plaintiff. Vice-President of plaintiff in charge of all tape research and tape manufacture of plaintiff:

Direct Examination.

. . . . . .

[47] A. I can recall specifically that in 1938 I made a number of attempts to make a satisfactory vinyl film-back pressure-sensitive adhesive tape. . . . All attempts were unsatisfactory. The pressure-sensitive adhesives became very soft and gooey and pasty and in any attempt to unwind the rolls the adhesive split, leaving half of the adhesive on the back side of the underlying layer of backing.

Q. Did you form any opinion as to why it was difficult to make a commercially successful pressure-sensitive tape at that time; I mean the reason for your failure? A. Yes. . . . [48] The pressure-sensitive adhesives absorbed the migratable, oily type plasticizers that were then used to plasticize the polyvinyl chloride, or vinyl chloride-vinyl acetate copolymer resin, and in the process of being added to the pressure-sensitive adhesive they spoiled the original character of the pressure-sensitive adhesive.

. . . . . .

[52] A. Yes, they obtained a successful conclusion and solution to that project or problem in October of 1944.

Q. Will you tell us briefly how that first tape of this type was made? A. The tape was made with a pliable and stretchable plasticized polyvinyl chloride-vinyl acetate film backing; in other words, they utilized a vinyl chloride-vinyl acetate copolymer resin, namely, VYNS. That resin was plasticized with a non-volatile, non-migrating plasticizer comprising Paraplex G-25 and dioctyl Phthalate. The film backing was primed and coated with a pressure-sensitive adhesive.

[53] Q. I understand this tape was later made commercially; is that correct? A. Yes, it was. It was sold in 1945 and formulations substantially the same as that have been sold continuously up to the present time.

. . . . . .

[87] A. . . . The plasticizer, the liquid type plasticizer has migrated from the backing into the adhesive, making it very soft and gooey and valueless.

. . . . . .

[103] Q. Well, can a viscous liquid polymerized ethyl acrylate be divided into a low-molecular-weight fraction and a high-molecular-weight fraction? A. Yes, very definitely you can fractionate the polymerized resin onto a low-molecular-weight liquid fraction and into a higher-molecular-weight liquid fraction, more viscous resinous fraction.

. . . . . .

[121] Q. . . . Now, first, Mr. Tierney, what is a copolymer? I don't believe we have had that defined. A. A copolymer is the combination of two monomeric materials, that is, different monomeric materials.

Q. Then do we understand that they mix together the vinyl choride and the vinyl acetate in certain proportions, that each is in monomer form, and then polymerize the mixture; is that the way it's accomplished? A. Yes, originally

they would take the vinyl chloride monomer in the proportion of 89 parts by weight and combine it with the vinyl acetate monomer in the proportion of 11 parts by weight and copolymerize them to higher molecular weight material, namely, to make a copolymer, [122] or a copolymer of those two materials, in which the vinyl chloride would be present in major proportion.

. . . . . .

[134] A. Yes, Minnesota Mining and Manufacturing Company has sold a considerable quantity of stretchable pressure-sensitive insulating tape that corresponds essentially to example 1, . . .

. . . . . .

[143] Q. Now I think generally we've covered the patent. I have some other questions now. Has the material that is sold by Rhom & Haas, and was sold by them under the trade designation of Paraplex G-25, undergone any observable change over the years, that is, from the time it was first brought to the attention of your company? A. Yes it has. In 1944 to 1945 the Paraplex G-25 that we received, had a film of oil on the surface of the containers, and the Paraplex G-25 which we have received in recent years, has had no such liquid oil on the surface of the containers as we receive it from Rhom & Haas Co.

Q. Now is there any other difference between the recent supply of this Paraplex G-25 as compared with that furnished to your company by Rhom & Haas in the year 1945? A. Yes, the observable difference that today when we utilize the current vintage type of Paraplex G-25, we can make a satisfactory stretchable and retractable pressure-sensitive adhesive tape, with it as the sole plasticizer. We had no success in doing that in the period 1944 and 1945 because such tape as was made with the Paraplex G-25 of [144] that

vintage, lost its pressure-sensitive adhesiveness within one or two days after the tape was made. . . .

. . . . . .

[164] Q. Mr. Tierney you said this morning that Van Cleef reached the market in 1949. What other competitor manufacturer reached the market? A. The next competitive imitation of the Oace patented product reached the market in the last part of 1949 and the early part of 1950. That was the plastic tape manufactured and sold by Technical Tape Corporation.

. . . . . .

[166] Q. Now Mr. Tierney, have you an example of the material known as the polymerized ethyl acrylate? A. Yes I do.

Q. All right, the bottle that is before you, I ask to be identified as Exhibit T-18. Now, what's the nature of this material? A. This is a soft viscous resinous material, somewhat [167] more viscous than the Exhibit 17 that I just talked about. It is a high molecular weight resinous material.

Q. Well, how does its physical characteristics compare with a plasticizer of the material that is contained in Exhibit 17, which was the G-25 plus the DOP? A. It is a liquid material, somewhat more viscous in character than Plaintiff's Exhibit T-17.

. . . . . .

[171] Q. Now have you a sample of the tape that was made with the G-25 of the current production, that is, of the current vintage, as the sole plasticizer? A. Yes, I do.

Q. I believe that is identified as Exhibit T-21 and so marked?

. . . . . .

A. . . . That plasticized film was primed with the primer number 2 of the [172] Oace patent and coated with pressure-sensitive adhesive of Example Number 5 of the Oace patent. The backing is 4 mils.

I might mention at this time that the 3.6 parts of stabilizer was also used in the Example T-19, which utilized G-40 as the sole plasticizer. The .7 parts of carbon black was also utilized in the T-19; and the T-19 also has the primer number 2 of the patent and the pressure-sensitive adhesive of Example No. 5 of the patent.

. . . . . .

[173] A. Yes. The bottle sample that I now have in front of me represents G-25 of current vintage. It is Exhibit T-22.

. . . . . .

Q. Can you indicate the characteristics of it as to viscosity and so forth? A. It is a liquid, viscous resin. As I turn the bottle on its side, you will notice that its viscosity is somewhat higher than the viscosity of the Paraplex G-40, but it is liquid and viscous and it is resinous.

. . . . . .

[176] Q. Have you analyzed this G-25, current G-25, to determine the range of molecular weights? A. Yes, I have had such current-vintage Paraplex G-25 analyzed for its percentage composition of the different molecular-weight fractions.

Q. Do you remember the range? A. Yes. The molecular weight ranges from one thousand to approximately fifty thousand.

. . . . . .

[177] A. Yes, T-20 is the Paraplex G-40 itself, as it is sold by the Rohm & Haas Company. Exhibits T-24 and T-24-A represent the fractional parts of the original Paraplex G-40 that is represented by Exhibit T-20. In other words,

in this bottle, namely, Exhibit T-24, we have 67 per cent, which is the more viscous, higher-molecular-weight resinous portion of the Paraplex G-40, or the Paraplex G-40 as represented by Exhibit T-20. Exhibit T-24-A represents 33 per cent of the original Paraplex G-40, which is the more liquid, lower-molecular-weight part of the original Paraplex G-40. If I add these two bottles [178] together and homogeneously mix them, that is, the Exhibit T-24 and the Exhibit T-24-A, I get six ounces, exactly the same thing that I have in Exhibit T-20; I get the original Paraplex G-40 back again.

. . . . . .

[179] Q. (By Mr. Kingsland) Now is the liquid fraction, that is, the material exemplified by the material contained in the bottle marked 24-A, a plasticizer A. It is.

Q. Is it an ester plasticizer? A. Yes, it is.

Q. And is it a liquid ester plasticizer? A. Yes, it is.

Q. Is it a liquid phthalyl plasticizer? A. No.

Q. Well, what is it? A. It's a liquid adipyl plasticizer.

Q. What is the relationship between a liquid phthalyl ester plasticizer and an adipyl ester plasticizer? A. They are both plasticizers; they are both esters of organic dicarboxylic acids; they are both liquid; they are both nonvolatile.

. . . . . .

[180] Q. Well now, what conclusions do you draw in respect to the similarity or difference in function between this liquid ester fraction of Exhibit 24-A when combined with a high molecular weight fraction from Exhibit T-24 as compared with the function of a liquid phthalyl ester plasticizer when combined with a high molecular weight Paraplex G-25 in current production? A. The conclusion that I draw is that the same function is obtained in both cases, and the same end result is obtained by the same method of blending

and procedure. [181] In the mixing of the low molecular weight, ester plasticizer of Exhibit T-24-A, with the viscous alkyd resin plasticizer of Exhibit T-24, a plasticizer is obtained that gives essentially the same function as the combination of the Paraplex G-25 in the ratio of 2 parts to 1 part of DOP. Now, that same result is obtained by using the two parts of the viscous resinous material of Exhibit T-24 with 1 part of the liquid low molecular weight ester of Exhibit T-24-A.

. . . . . .

A. Yes, I have had Paraplex G-25 of current vintage fractionated in the same manner as utilized in the fractionation of Paraplex G-40, and the two bottles that are now in front of me, namely, Exhibit T-25 and Exhibit T-25-A, represent the results of that fractionation. You will notice that this time the amount of the low molecular weight liquid fraction is about half that amount that was [182] fractionated from the Paraplex G-40. In this case, with the Paraplex G-25, the liquid fraction of low molecular weight that was separated from the original Paraplex G-25, amounted to approximately 12% of the original Paraplex G-25. That 12% portion of liquid material is represented by Exhibit T-25-A, and as I turn the bottle on its side you can see its liquid character. The Exhibit T-25 represents the viscous higher molecular weight resin portion, namely, 88% of the original Paraplex G-25.

. . . . . .

[183] Q. Now, there has been a discussion about these phthalyl esters, the sebacic acid esters and the adipic acid esters. What generally is the relationship between these esters? A. They are all liquid plasticizers offered in commerce, in the same grouping and referred to in the literature in the same groupings. They are each the ester of a di-carboxylic acid, namely, the phthalyl ester is the ester of

the di-carboxylic phthalic acid, the sebacyl ester is the ester of the di-carboxylic sebacic acid and the adipyl ester is the ester of the di-carboxylic adipic acid.

. . . . . .

Cross Examination

. . . . . .

[230] XQ. Now I think, Mr. Tierney, you said that Minnesota made some 300 different kinds, as I remember it, of pressure-sensitive adhesive tapes. Is that correct? A. Yes sir. At the present time we have over 300 different standard tapes of pressure-sensitive adhesive tapes that are being marketed.

XQ. In 1940, let us say, I presume you didn't have as many as 300 but you had a great many at that time? A. We had a great deal less than 300 in 1940. I believe, however, that even at that time we were probably marketing at least 90 or 100 different types of standard pressure-sensitive adhesive tapes.

. . . . . .

[231] XQ. Now each of these materials, I assume, were selected because of its properties in relation to the end use, so to speak? A. Yes, it had a great deal to do with that in many instances.

XQ. Now, all these tapes that I have just been speaking about back in 1940, all had pressure-sensitive adhesives, and those pressure-sensitive adhesives, I assume, were cuco-hesive as defined in the patent, that is, more cohesive—had more cohesive strength than adhesive strength. Is that not correct? A. Yes.

. . . . . .

[237] XQ. Now you've testified that the rubber electricians' tape has a dielectric strength of about 350 volts per

mil and that the Scotch tape No. 33, your electric tape vinyl backed, has a dielectric strength of 1200 to 15,000 volts per mil. 1200 to 1500 volts? A. Yes sir.

XQ. That is because the vinyl chloride material has that inherent property of high dielectric strength as distinguished from the property of the rubber, which is less effective. Is that not so? A. The polymerized vinyl chloride resin itself, when sheeted in sheet form, has a higher dielectric strength than the uncured rubber.

XQ. And it was known— A. Of equivalent thickness.

XQ. And it was known prior to 1940 that polymerized vinyl chloride sheets of this character did have this excellent quality? A. Yes.

XQ. And for that reason had been used for insulation? A. Yes, they had been used as extruded compounds around copper conductors.

XQ. Well, they did make tapes of this material for electrical [238] uses as I understand. Those tapes had that same dielectric strength I assume? A. Yes, tapes made of the straight vinyl film alone, without any adhesive, and as I testified, were used for insulation purposes, and regarded generally as superior to the rubber tapes, that is, the rubber electrician tapes.

. . . . . .

[247] Is there any significance in the reference, in the first place, in line 41, column 1, to a liquid type plasticizer, and then over at column 5, in the first paragraph, it says many liquid plasticizers; is there any difference between liquid and liquid type that you know of?

The Witness: In that particular two places only, where Mr. Holmes has had me draw reference to in the patent, there is no difference, because dioctyl phthalate, which appears as the liquid type plasticizer in column 2, line 41, and the specific liquid plasticizers that are mentioned in

column 5, lines 1 to 16, could similarly be called liquid type plasticizers, that is, tricresyl phosphate, dibutyl phthalate, butyl phthalyl butyl glycollate is liquid type like dioctyl phthalate, or DOP, and if these plasticizers are used in more than twenty parts per hundred parts of the vinyl resin they will produce pastiness, as the patent states.

. . . . . .

[252] A. The patent states, at line 34, column 3, that Paraplex G-25 is a preferred example of a suitable resinous type plasticizer which is of high-molecular-weight material, namely, one of a number of high-molecular-weight [253] plasticizers that the patent specifically mentions.

XQ. All of which can be properly catalogued as of the resinous type? A. Yes, they are all resins; they are different kinds of resins. Polymerized ethyl acrylate is a different type of high-molecular-weight resin than the Paraplex G-25. Both of them are high-molecular-weight plasticizing modifiers for the vinyl polymer film. Polymerized vinyl butyl ether is a still different type mentioned in the patent.

. . . . . .

[254] XQ. That isn't my question. This paragraph twice refers to "resinous type plasticizers" and they mention three, Paraplex G-25 and in the same paragraph polymerized ethyl acrylate and as another example, polymerized vinyl butyl ether. Now, those are all three a resinous type of plasticizer are they not? A. They are all resinous type plasticizers . . .

. . . . . .

[256] XQ. Would it be equally accurate to say that that backing comprised a—the plasticizer comprised a mixture of G-25 and DOP instead of saying it is a blend. Mixture would be more accurate would it not? A. The plasticizer

comprised a mixture of 2 parts of Paraplex G-25 to one part of Djoctyl Phthalate.

XQ. Now, each of those constituents maintains its identity, so to speak, in the mix, does it not: For instance, you can subject it to a vacuum and the DOP will come off. There has been no chemical union of the two, so to speak? A. There has been no chemical union between the Dioctyl Phthalate and the Paraplex G-25. It is a physical combination of the two materials.

. . . . . .

[259] XQ. Well, paragraph 3—column 3, line 34, says that Paraplex G-25 is a preferred example of a suitable resinous type plasticizer, and it says that another of these materials is polymerized ethyl acrylate, then another example, G-25 being the preferred, is polymerized vinyl butyl ether. Those are all three resinous types of plasticizers I gather, of high molecular weight. Is that not so? A. Yes they are.

. . . . . .

[263] Now the patent points out there that, to get the permanent equilibrium and also the stretchiness, you should utilize a combination of modifiers, one of which is a liquid plasticizer of low molecular weight, combined with a high molecular weight resinous type plasticizer. Now that language does not exclude the case where the material, the plasticizing material itself, can have both the low molecular weight liquid plasticizing material along with the high molecular weight resinous type plasticizing material, because in a separate sentence, starting in column 3, line 40: "Another high-molecular-weight plasticizer material which has been found useful in providing suitably stretchable and elastic vinyl polymer films is polymerized ethyl acrylate and polymerized ethyl acrylate has both low molecular weight liquid plasticizer and high-molecular-weight resinous plasticizer in it, in the same material, [264] in the

the same way that Paraplex G-40 has both the low-molecular weight liquid plasticizer present in it along with the high-molecular-weight resinous plasticizer.

. . . . . .

[276] XQ. Did they try the home made G-25 as referred to in column 5, line 26? Did they try that as the sole plasticizer? A. I have no specific recollection, but may I explain that I am sure that they must have tried that as well as the polyethyl acrylate and the polymerized vinyl butyl ether because I am sure if they had not tried them, the references that are contained in this patent would not be within the specification.

. . . . . .

[277] XQ. Did this home-made Paraplex G-25 have an oil film on it? A. No, sir. . . .

. . . . . .

[288] A. Oh, if I understand your question correctly, you are asking how long we continued the use of the formula comprising 100 parts of the vinyl polymer resin in conjunction with the plasticizer comprising 28.6 parts to 40 parts Paraplex G-25 or Paraplex G-40 and 14.3 parts to 20 parts dioctyl phthalate, based on 100 parts of vinyl resin, along with approximately 3.6 parts of calcium stearate stabilizer, or the equivalent.

XQ. I didn't say anything about G-40 in Example 1. [289] How long did the use of G-25, with the DOP, remain as the sole formula?

The Court: As shown by Example 1—that's what you have been talking about.

XQ. As shown by Example 1.

. . . . . .

[290] A. We started to use Paraplex G-40 in 1946 and 1947.

XQ. Now G-40 you substituted for the Paraplex G-25 in substantially these same proportions of Example 1; is that so? A. Yes.

. . . . . .

[291] A. That has continued up through 1953. . . .

. . . . . .

[292] XQ. When did you first make commercially, tape in which the backing was plasticized with a resin plasticizer as the sole plasticizer? A. I believe 1953 was the first year.

XQ. And since '53, has that continued, the manufacture of the tape with the resin plasticizer that's the sole plasticizer? A. Yes, for a very small percent of our total volume. The major part even today, is essentially the same as the examples of the Oace patent.

. . . . . .

[296] XQ. Now, the liquid type of plasticizer as exemplified [297] by DOP, is a low molecular weight plasticizer. Is that not so, somewhere around 390? A. The molecular weight of DOP is 390. It is low or high, depending upon what it is being compared to.

XQ. Now those molecular weights are specific molecular weights. Every molecule is the same. Is that not so? Substantially the same? A. The molecular weight of each molecule of DOP is the same weight, yes.

XQ. Now that holds true also does it not for the other liquid type plasticizers enumerated in column 5, the first paragraph? A. The specific liquid plasticizers mentioned in column 5 between the lines from 1 to 9, all are similar to DOP in that respect.

XQ. Now DOP and these others are not only of low molecular weight but they are generally classed, are they not, as migrating plasticizers? A. Yes, when used along with vinyl chloride or vinyl copolymer resin films, they are termed migrating plasticizers.

XQ. Now these plasticizers also are very fluid. They will pour almost like water? [298] A. They are more viscous than water. They are quite fluid.

XQ. Very fluid. That's very fluid is it not? (Indicating Exhibit T-23 in the bottle)? A. Yes, they are more viscous than water.

The Court:

Q. It is descriptive, though, of a liquid plasticizer isn't it? A. Yes.

. . . . . .

[300] XQ. Have you ascertained what the weight distribution of G-40 is? A. Yes sir I have.

XQ. The range? A. Yes sir I have.

XQ. How is that range? A. That ranges from 1000 to 50,000, but the molecular weight distribution indicates that there is present in it [301] a far larger quantity of lower molecular weight material than is present in the Paraplex G-25.

. . . . . .

[302] XQ. But it remains resinous does it not? A. Yes, the portions of Paraplex G-25, the molecules and the parts of it, would all probably qualify for the term resin.

. . . . . .

[303] XQ. Now, as to T-24, what you would term the light fraction remains a resin, T-24-A, a non-migrating resin plasticizer, does it not? A. I believe you have two sections in your question, or two parts of it. My answer to the first part is that the low-molecular-weight portion, the liquid part, Exhibit T-24-A, is properly termed a resin. I have forgotten now the second part.

XQ. And it is a non-migrator; is that not so; it would be so classed? A. It is non-migrating when it is combined with its complementary portion, namely, the higher-molec

ular-weight, as that viscous alkyd resin portion of the Paraplex G-40, which is exemplified by Exhibit T-24.

XQ. Is it not substantially non-migrating by itself? A. It is non-migrating under what conditions and with what, sir?

XQ. Well, any vinyl chloride? A. Under what conditions, sir?

[304] XQ. Normal conditions, in a tape. A. In the pressure-sensitive adhesive tapes such as we are talking about here?

XQ. Yes. A. I believe it would be non-migrating. Certainly it would not migrate as much as the dioctyl phthalate.

. . . . . .

[305] A. Those materials were fractionated by George Rathman of our polymer section at my request within the last forty days.

XQ. And these are the results that he handed out to you? A. Yes they are.

XQ. Did you see the fractionating process proceed? A. No.

[306] XQ. Now when did you make the polymerized vinyl ethyl acrylate which you said was fractionated by Dr. Rathman? A. Your question had reference to the tape?

XQ. No, the polymerized ethyl acrylate which is Exhibit T-18? A. That material was produced sometime within the last 40 or 50 days.

. . . . . .

XQ. Now, take T-24-A which is the less viscous fraction of the G-40, which was T-20, what is the molecular weight of that fraction? A. The weight average molecular weight of the material [307] of Exhibit T-24-A is 5300, so that the approximate number average molecular weight on that basis would also be approximately half, in the range of 2500, indi-

cating that the liquid material there has from 1 to 20 links of the original unit, whereas the T-24 has material that runs all the way up to 150 links.

XQ. You have said that the liquid material has so and so. Would it be accurate also to say that the resinous material has so and so, of T-24-A? A. Yes.

. . . . . .

[308] XQ. Now, T-25-A was the less viscous alkyd resin portion of the G-25. What is the molecular weight of that less viscous alkyd resin portion? A. The weight average molecular weight of Exhibit T-25-A is approximately 10,000, which means that in that liquid material there are from 1 to approximately 36 links of the original unit.

XQ. Now when Dr. Rathman fractionated the samples, what method did he pursue? Would you state it in reasonably simple terms so I can understand it and it will have to be simple?

. . . . . .

[309] A. The way they are separated, it is in just the reverse order of what you just stated. The higher molecular weight material comes out and then as you go along progressively the material of lower molecular weight tends to separate out until finally you are left with the material of the low molecular weight, which formed the liquid fraction.

XQ. Well, it goes along progressively, so to speak; some heavy material comes off, and then some more, and then some more, and so on? A. Yes.

XQ. So, in fractionating, you can divide the material into any sized fractions you desire, can you not? A. Yes.

XQ. You can get a fraction of fifty per cent, the heavier material, and then take that and what is left is fifty per cent of lighter material? A. Yes.

[310] XQ. And then you can take off twenty per cent of the heavier material, on that side, and then what is left is eighty per cent which is lighter and less viscous? A. Yes.

XQ. Now, with the G-25, Dr. Rathman chose to stop, or to proceed to cut off eighty-eight per cent of what he terms, as I understand it, what he would term, the heavier or more viscous resin, and then twelve per cent of the less viscous resin fraction; is that right? As I remember it, those were substantially the percentages, eighty-eight and twelve. A. Yes.

XQ. And, with the G-40, Dr. Rathman chose to progress a little further, I gather, until he had taken off approximately sixty-seven per cent of what is termed the heavier fraction, leaving thirty-three per cent of the less viscous resin of the original material. Is that not so? A. Yes.

XQ. Now, he might, with the G-25 he might, have chosen to have the same ratio of sixty-seven to thirty-three, if he had chosen, might he not? A. Yes, he might have, but it is unlikely that he would have, because I asked him to separate the liquid [311] fraction of low molecular weight from the original Paraplex G-25 and the Paraplex G-40. Now I mentioned earlier that the Paraplex G-40 has a molecular weight distribution which indicates that there is a much greater quantity of low molecular weight material present, that is, a much greater quantity of liquid ester material of low molecular weight present in the Paraplex G-40 than there is in the Paraplex G-25.

XQ. Well, he might have chosen different fractions for each had he desired; that's all I wanted to know? A. I don't know what he might have chosen. I told him to separate the liquid material from the Paraplex G-25 and the liquid material from the Paraplex G-40, and that is what he did.

XQ. Did you tell him what your standard of the vague

and broad term "liquid" was? A. I don't recall that I indicated to him any standard for "liquid," no, sir.

. . . . . .

[313] A. The ester generally does have an ester chemical structure.

XQ. And, yet, it is termed an ester, regardless of what the constituent elements, what the chemical compound is; whether it's a solid, or a liquid, or whether it's an oil, or whether it's a wax, or whateyer it is, it would still have the chemical structure termed an ester; is that not so; it may still have the chemical structure termed an ester? [314] A. An ester is the chemical combination of an organic acid and an alcohol, that is, a hydroxy compound. Now esters may be liquid or they may be solid, depending—

. . . . . .

The Witness: Yes, esters may be a gas, under certain temperature conditions and atmospheric pressure—certain pressure conditions.

XQ. (By Mr. Holmes) Well, the term is so broad, then, is it not, as to include literally millions of widely different chemical compounds, each one of which could be referred to as an ester; is that not so?

. . . . . .

The Witness: Yes, it can refer to a broad class of materials.

. . . . . .

[315] XQ. Does the term "ester" encompass, to use some homely examples, such widely different compounds or materials as acetate rayon, photographic film? A. Cellulose acetate is an ester. Photographic film may be an ester or not, depending on what you mean by photographic film.

. . . . . .

A. Vinyl acetate is an ester.

. . . . . .

[316] XQ. Is T-24, which is the heavier, more viscous fraction of G-40, an ester plasticizer? A. It is chemically a polymeric ester plasticizer that is non-migrating in character.

XQ. So it is an ester plasticizer, using that term in its broad classification as we have been using it so far, as having an ester chemical structure? A. It is what they call a linear polyester plasticizer, yes.

XQ. And it could be termed an ester plasticizer? A. Yes.

[317] XQ. If you wanted to be more precise, you would call it a polyester plasticizer? A. Yes.

XQ. But it is an ester plasticizer? A. Yes, it would also qualify for that description.

XQ. So esters, in relation to plasticizers, may be of a migrating liquid type, or they may be of a non-migrating resin type? A. Yes. The liquid portion of Paraplex G-40 is properly called an ester, and the higher molecular weight portion may be properly called an ester plasticizer.

XQ. And the liquid type of migrating plasticizer, such as DOP, may properly be termed an ester plasticizer? A. DOP is an ester plasticizer.

XQ. Now this particular classification, as I understand it, of esters has been divided into, for purposes of more precise identification, into monomeric esters and polymeric esters; is that not so? A. There are monomeric ester plasticizers. DOP is an example of an ester plasticizer where the individual units of the plasticizer are all composed of the single chemical compound DOP; in other words, you do not have two, three or more units chemically linked together. You also have in Paraplex G-40, for example, which [318] is a plasticizer, you also have esters that are linked

together as is the case where polymers are present, as is the case in the Exhibit T-24.

XQ. And when those monomers are linked together by polymerization, the product, such as G-40, is termed more specifically a polymeric ester; is that not so? A. Yes.

[319] XQ. So T-24, T-24-A, T-25, T-25-A are all polymeric esters. Is that not correct? A. They are all polymeric esters.

. . . . . .

XQ. And you referred to the heavier portions of the fractions as the portions or fractions of these polymeric esters as viscous resin plasticizers. Now, why did you refer to T-24-A as an ester plasticizer and T-24 as a resin plasticizer? A. Because that is what they are.

. . . . . .

XQ. And with equal accuracy you could have called T-24 an ester plasticizer. Is that not so? A. T-24 is an ester plasticizer of very viscous character because it is polymeric.

. . . . . .

[320] XQ. And when you call T-24-A an ester plasticizer, you do not distinguish it in any way from DOP? A. That's right, they are both properly called ester plasticizers, and they are both liquid and both of low molecular weight as contrasted to the material of Exhibit T-24, which is the soft, viscous resinous portion of higher molecular weight Paraplex G-40.

XQ. By calling T-24 a resin plasticizer, you do distinguish it from a liquid type DOP do you not? A. DOP is generally not called a resin.

XQ. Is it ever called a resin? A. No it is not, not that I have ever come across.

XQ. So if you want to distinguish T-24-A from DOP, you

do, and you have in this testimony, called T-24-A a resin plasticizer? A. It is a liquid ester plasticizer.

. . . . . .

[321] XQ. But that term, liquid ester plasticizer doesn't distinguish it from DOP. Anyone reading the words "liquid ester plasticizer" might think that could refer to DOP. Is that not so? A. There was no additional distinguishing adjectives used in that connection because both DOP and the liquid material of Exhibit T-24 are properly called liquid ester plasticizers. Now, the material of T-24-A may also be called a resin because it is a resin, and it is also liquid and it is also an ester, and it is also of low molecular weight as contrasted to the very viscous fraction of the origina.. Paraplex G-40, namely, Exhibit T-24.

XQ. Well, I just wanted to be sure that anyone reading this wouldn't think that the T-24-A was being termed a liquid ester plasticizer; would think that it was a liquid type [322] migrating low molecular weight plasticizer such as DOP. That's all I wanted to make sure of. Now, when you mix T-24 and T-24-A, the more viscous and the less viscous fractions—resinous fractions of G-40, you restore the G-40 to the product you started with do you not? A. Yes, when you put the material of Exhibit T-24-A, namely, the two ounces of liquid material comprising the low molecular weight ester with the four ounces of viscous resin of materially higher molecular weight that is represented in T-24, you obtain six ounces of Paraplex G-40 of identical composition to the Paraplex G-40 as it is sold by the Rohm & Haas Company.

. . . . . .

XQ. Well, when you restore those fractions, put them together, you then have a non-migrating high molecular weight resin plasticizer? A. You have a non-migrating plasticizer which has a majority [323] of the material pres-

ent that is of high molecular weight, along with material that is liquid and of low molecular weight.

. . . . . .

[331] XQ. Now, is the resinous plasticizer G-25, a phthalyl ester? A. It is not.

XQ. Is the resinous plasticizer G-40 a phthalyl ester? A. It is not.

. . . . . .

[332] XQ. Did I understand you to say this morning, Mr. Tierney, with regard to T-24-A, that it had molecules of from one to twenty units or links? A. Yes.

XQ. And that T-25-A has molecules of from one to thirty-six units or links? A. Yes, sir.

XQ. Do you agree that you previously testified that [333] the lowest molecular weight in G-40 was a thousand? A. I may have said that, yes.

XQ. Then will you also agree that the unit of G-40 is about 174, or thereabouts? A. No, I will not agree to that. The individual unit of G-40, which constitutes the combination of adipic acid with two molecules of propylene glycol and the resulting elimination of two molecules of water, yields a unit that is 262, which is the molecular weight of the one unit of G-40 that may combine together with other units in making the polymer of increasing molecular weight in the polymeric material.

. . . . . .

[334] XQ. Your unit value was 262? A. Yes, that is the original unit of the reaction between adipic acid and two molecules of propylene glycol to form the di-glycol, di-propylene glycol adipate.

XQ. And dividing the 262 into a thousand we get approximately four? A. Yes.

XQ. And wouldn't that indicate, then, that the minimum length of chain was four or more, to a chemist? A. It

would. If I said that the Paraplex G-25 and the Paraplex G-40 was one to fifty thousand, I was giving the approximate range by molecular weight that is present. I will say that there may very well have been a small portion that would be from five hundred to fifty thousand.

XQ. But you don't suggest that there was a portion of monomer in there? A. There might be a very small portion of the original single unit present; it would be very small.

XQ. And you really mean very small? A. Yes.

[335] XQ. Such as would normally go out in a finishing operation of the material? A. I would say that it is present to the extent of less than one per cent.

. . . . . .

XQ. Is there any evidence of any monomer in the G-40 that you have ever seen or heard of? A. I, personally, have not found any, but I, personally, have not fractionated the G-40 or the G-25 with the express aim of attempting to determine whether there is any monomeric unit present of the reaction product of adipic acid and propylene glycol.

XQ. Now, passing to T-25-A, did you say that it has units from one to thirty-six or more? A. That was Exhibit T-25-A?

. . . . . .

[336] XQ. And what do you say as to the unit of 222 for G-25; will you accept that? A. No.

XQ. What is your figure, then? A. The molecular weight of the one unit of di-propylene glycol sebacate is 318.

XQ. And if we divide that into the one thousand which you gave for the minimum molecular weight of G-25, we come out three plus, do we not? A. There again if, in my previous testimony, I said one thousand to fifty thousand, I was giving an approximate range, and I repeat that in that instance also there might very well be from 318 to fifty thousand; namely, there might be some monomeric, single-unit

material representing the reaction product of sebacic acid and two molecules of propylene glycol, or, namely, the dipropylene glycol sebacate, which has a molecular weight of 318. There would be a very small amount of it, because there is a small amount even of the material that runs up to a weight average molecular weight of ten thousand. As you can see, the total amount of that material that is present in [337] the Paraplex G-25 of a molecular weight, that is, weight average molecular weight, of ten thousand or less down to 318 amounts to only twelve per cent of the Paraplex G-25 of current vintage. Now these fractionations were made of the Paraplex as of 1955 manufacture and sale.

XQ. In your opinion, in either G-25 or G-40 is there any significant separate amount of monomer? A. I don't know. . . . I will agree that the amount is small and undoubtedly is less than one per cent of the material as it is now being made by Rohm & Haas Corporation.

. . . . . .

[339] XQ. Is it your position that the old G-25 had more than a fraction of one per cent of the monomer present? A. No.

. . . . . .

JOHN M. DEBELL, witness on behalf of defendant:

Direct Examination.

. . . . . .

[417] A. I was graduated in 1917 from the Massachusetts Institute of Technology with the degree of Bachelor of Science in Chemical Engineering.

Q. Will you please state what your activities, occupations and experience have been since your graduation from Massachusetts Institute of Technology? A. The first two years after graduation I served with [418] the Armed

Forces of the United States; from 1920 to 1922 I was Assistant at the Massachusetts Institute of Technology to the Director of the Division of Industrial Cooperation and Research; from 1922 to 1932 I was employed by General Electric Company at Pittsfield, Massachusetts, where I was in charge of development and later manufacturing of two types of synthetic resins and molding compounds, including the alkyds and phenolic materials; from 1932 to 1936 I was a group leader at Hercules Powder Company, of Wilmington, Delaware, and during that time I introduced ethyl cellulose, a plastic material, into the United States; from 1936 to 1939 I was Director of Research and Development for the Fiberloid Corporation which, in 1938, merged with Monsanto Chemical Company and became the Plastics Division of that company; since 1939 I have been a consulting chemical engineer, working entirely in the plastics field.

. . . . . .

[419] Q. Since you left Fiberloid, what has been your occupation and experience? A. I have been a consulting chemical engineer in the plastics field. During the war I was consultant to the War Production Board, specializing in plasticizers, to the Office of the Quartermaster General and—

Q. Just a minute. Your War Production Board work did that concern not only plasticizers but polyvinyl compounds and so on? A. It did. And also to the Office of the Rubber Director, where again I specialized in plasticizers. In 1943 I set up a partnership, still in the consulting engineering field, which was incorporated in 1946 as DeBell & Richardson, [420] Incorporated, and that has continued to the present.

Q. How much of a staff does your laboratory have? A. We have currently about fifty people, of whom, roughly, one-half are graduate engineers or chemists.

. . . . . .

The Witness: It does experimental work and consulting solely in the plastics field, plastics including polymeric materials, modifiers, compounds, and processes, and equipment for those processes.

. . . . . .

Q. Do you design plants for making vinyl resin products? A. Yes, and for making the resins themselves.

[421] Q. Have you been the consultant for the major plastic and chemical companies in this country? A. Yes, broadly speaking, I think practically all the major ones with the exception of duPont and Carbide.

. . . . . .

Q. Are you the author of any work, scientific work, on plastics? A. Yes. Aside from magazine articles, I wrote, with Mr. Goggin, of Dow Chemical, and Mr. Gloor, of Hercules Powder Company, the comprehensive record of the German plastics industry entitled "German Plastics Practice."

Q. Did you tell me that at one time the Government sent you to Europe for this purpose of this book? A. Yes.

. . . . . .

[423] Q. And were the chemical properties and other properties of plasticized vinyl compounds well known in the thirties? A. Yes.

Q. Including the insulation quality? A. Yes, they were.

Q. Were they known to have high dielectric strength? A. Yes. That was a factor in their use in cable insulation.

Q. Water resistance? A. Yes.

Q. Oil resistance? A. Yes.

[424] Q. Resistance to weather and sunlight, and so on? A. Yes, reasonably good, especially if pigmented.

Q. And resistance to chemicals, gasoline? A. Excellent chemical resistance, and especially toward the aqueous types of chemicals.

Q. That was all well known? A. That is right.

Q. Now reference has been made, and is made in the patent, I believe, to copolymers of vinyl chloride and vinyl acetate with a high vinyl chloride content. What is the significance of having the vinyl chloride content a high one? [425] A. When the vinyl chloride content is high, it has been found that the polymers of that composition give the greatest strength, toughness and resilience, especially in plasticized film. They also have a sufficient softening temperature.

Q. That was all known in the thirties? A. That is correct.

Q. So the high vinyl content is perhaps essential for such a product as a tape. Is that not so? A. That is correct.

. . . . . .

[426] Q. Is it desirable that the mixture of the vinyl with the plasticizer, or plasticizers, should be a homogeneous one? A. It is very important because the subjection to heat must be somewhat limited, the temperature must not rise too high, so that it is always customary to get as perfect a mixture as you can before the heat treatment, and then to mill sufficiently to get a completely homogeneous structure.

Q. And that was standard practise in the thirties? A. That is correct.

. . . . . .

[428] Q. Prior to the war, had any particular plasticizer for vinyl compound won its way as the preferred plasticizer? [429] A. Yes, DOP was a very much preferred plasticizer for polyvinyl chloride before the war.

Q. And would you say that the use of DOP had become more or less the accepted plasticizer, in practice? A. Yes, it was then and for many years after.

Q. Now what qualities does this preferred type of liquid plasticizer, DOP, have that made it particularly desirable? A. DOP is a good solvent, that is, a good plasticizer. It has good solvent power for polyvinyl chloride. It has very low volatility; it maintains good flexibility in films at quite low temperatures; it has good color; it is not particularly toxic; and it is comparatively low in cost.

Q. Is it easy to incorporate into the material? A. It incorporates very readily.

. . . . . .

[429] Q. Was it known—I don't know whether I have asked you this before—that all liquid plasticizers were migratory? A. Yes.

. . . . . .

[430] Q. The Oace patent, column 2, line 41, refers to "liquid type plasticizers" and in column 3, line 30, it refers to "rosinous type plasticizers". As thus defined by Oace, are these two types, two well recognized and defined, distinctive types of plasticizer? A. Yes they are, and they are quite well defined by Oace himself in his examples. For example, on liquid type plasticizers, he mentions in column 3, line 27, Dioctyl phthalate, and in column 5, line 7, tricresyl phosphate, and dibutyl phthalates and butyl phthalyl butyl glocollate. All these are liquid plasticizers, as that term was then generally used in the technology of this art. Those liquid plasticizers had many properties in common. They are all monomeric, that is, they are very simple, precise, well defined chemical compounds of molecular weights of the range from say 250 to 600 or thereabouts. They are thinly fluid. For example, you already have in evidence, and I have here a tube of dioctyl phthalate, and you can see that a bubble rises very rapidly through this plasticizer. It has a viscosity of less than one poise, the poise being a unit in which such

viscosities are [440] measured. It is so mobile as you can see that it is migratory. It is so liquid that it will move readily when given an opportunity. Furthermore, every molecule in this plasticizer is just like every other molecule, so that it cannot be fractionated.

Q. And what you have said as to the DOP, is that true of all the other liquid plasticizers? A. Those characteristics of monomeric structure, migration, low viscosity, low molecular weight,—

Q. Thinly fluid? A. Thinly fluid, apply to all the liquid plasticizers mentioned by Oace and also those which were customary in the trade.

Q. Now what does resinous type mean to you? A. Well, a resinous type plasticizer is a synthetic material made by combining chemicals to a very high molecular weight so that you obtain an extremely viscous plasticizer, the viscosity for example of this tube of G-25 which I hold before you is about a thousand poises. The molecular weight is very high, in the thousands, and it is quite variable because there are molecules, as you have heard in previous testimony, all the way from a thousand in size to 50,000 in size, and this, unlike the DOP or the liquid plasticizer, here is a great big, clumsy molecule, it is huge, it doesn't [441] move fast, and it doesn't migrate, and since it has variable molecular weight, it can be cut into fractions of different molecular weight and each one of those fractions can be further cut into more fractions, all of which are resin plasticizers, taken from the resin plasticizer with which you start.

Q. You say "variable molecular weight". Is it all high molecular weight? A. As I pointed out, it is extremely high molecular weight, well into the thousands.

Q. Are the resinous type plasticizers commonly called polyesters? A. Yes, they are properly so termed.

Q. Also are they properly termed polymeric? A. Yes they are polymeric.

Q. I think you have already stated, but I'll ask you, is the resin type a distinct well recognized type as meaning what you are saying, high molecular weight, viscous, non-migrating, material as distinguished from a semi fluid thinly fluid liquid type. Is that correct? A. It is.

Q. Would you say that in chemical parlance, and as particularly defined by Oace, the liquid type and the resinous type are two well known distinctive types which are mutually exclusive and do not overlap? A. That is correct.

. . . . . .

[447] Q. Is a resin type plasticizer, a liquid type plasticizer? Is that term used in these examples I am giving you? A. The resin type is not properly called a liquid type plasticizer, as we in the trade, and Oace, have defined it. It is quite true that as a state of matter, the resin type plasticizer is a liquid, a very heavy viscous liquid, which can in time be poured. However, it is so distinct in its properties from the liquid type plasticizers, that it is not properly described as a liquid type plasticizer.

Q. Can you properly describe any part of it as a liquid type? A. No. No matter how far it may be fractionated, all of the fractions partake in their properties of the typical resin type plasticizer.

Q. And are non-migrating? A. Non-migrating and high molecular weight.

Q. Now I think I heard, and I think perhaps you did in your testimony, referred to a liquid type plasticizer as monomeric. Is that correct? [448] A. Well yes, that is a proper designation and that means that it has one form, it is a simple precise molecule.

Q. Now on page 326 of the record Mr. Tierney stated that he did not understand what I meant by a monomeric

plasticizer. Do you understand what is meant by a monomeric plasticizer? A. Yes I do.

. . . . . .

[449] Q. And does the art understand what is meant by "a monomeric plasticizer"? A. Yes, it does.

. . . . . .

[451] Q. Now, is this classification which appears in this technical literature of monomeric, on the one hand, and polymeric, on the other, is that the same classification [452] really that is made by Oace when he refers to "liquid type" and "resinous type"? A. Yes, all the liquid plasticizers mentioned by Oace fall in the monomeric class, and all the high molecular weight polymeric types, examples, fall in the resinous class, or, rather, his resinous examples fall in the polymeric class.

Q. Well, the two classifications are parallel, monomeric and liquid, and polymeric and resinous; is that not so? A. That's correct.

Q. What is the significance of the word "ester," which has popped up in this case? A. "Ester" is a broad chemical term which signifies a particular type of chemical linkage. Practically everything, with the exception of vinyl isobutyl ether, practically all of the plasticizers, both liquid and resinous, of the Oace patent are chemical esters. However, in the trade, the term "ester plasticizer" came to mean sometime ago the liquid plasticizers, probably because of the historical order in which these plasticizers appeared and were used, so that the trade, by "ester plasticizer," ordinarily understands the liquid plasticizers of Oace, although it is quite true that almost every plasticizer in Oace has an ester structure.

Q. Has the art come to use "ester," the word "ester," as applied to plasticizers, exclusively to the monomeric type? [453] A. I would say largely. There are occa-

sional rare instances in which a publication will refer to ester plasticizers as something other than that, but in practically all cases the trade understands by "ester plasticizers" the liquid plasticizers we are here discussing.

. . . . . .

[455] Q. Do I understand that the term "polyester" means and is used to differentiate the high molecular weight resin type from the liquid ester type; is that correct? A. Yes, that's correct.

Q. I read from page 20 of the St. Paul depositions, our examination of Esther Eastwold, of the Minnesota Company, and I quote: "Q. What sort of plasticizer did you use?" "A. We used monomeric plasticizer and polymeric plasticizer." Was Mrs. Eastwold there, according to chemical usage, clearly defining the liquid types and the resin types of Oace? A. I would understand that she was referring respectively to liquid type and the resin type.

Q. What does "liquid phthalyl ester plasticizer" describe? A. The liquid phthalyl ester plasticizers are the simple monomeric esters of phthalic anhydride with a suitable alcohol, for example, DOP, dibutyl phthalate, diamyl phthalate, or materials of that kind.

Q. Are there liquid plasticizers which are not phthalyl? A. Yes.

[456] Q. Referring to the Oace patent, are the liquid plasticizers referred to in column 5, the first paragraph, of the ester type, as that phrase is used in the art and in the literature you have referred to? A. Yes, those are ester type plasticizers.

. . . . . .

Q. Does the patent clearly distinguish between liquid type plasticizers and resinous type? A. Yes, it distinguishes between them at the very be- [457] ginning of the description, in column 3, line 27 and line 29, and throughout

the patent there are constant references to this two-plasticizer system, the liquid plasticizer of column 3, line 27, and the resin type plasticizer, same column, line 31. The liquid plasticizers are detailed in column 5, the first paragraph. The resin plasticizers are detailed in the following paragraph. Further references to this two-plasticizer system are in column 5, line 16; in column 7, lines 5, 6 and 7; in column 7, line 16—

. . . . . .

Q. What is the teaching of this Oace patent, Mr. DeBell, to you, as a man familiar with this art? A. The Oace patent teaches that a two-plasticizer system makes a successful pressure-sensitive vinyl-backed tape. It overcomes the previous objection that all-liquid type plasticizers could not be used because they would interfere with the film, and it points out that all-resin type plasticizers [458] can not be used because they interfere with the film.

. . . . . .

[459] Q. Is there any statement, suggestion or intimation in this patent as you read it, that any resinous type of plasticizer can be used successfully as the sole plasticizer? A. I find no such suggestion, and in fact the patent warns against it. . . .

. . . . . .

[467] Q. Now, referring to G-40, I think you said that is a resinous type as distinguished from liquid type. Is every part and portion of G-40, of the resinous type as distinguished from a liquid type? A. Yes, it is.

Q. However fine you fractionate it, it is still viscous, nonmigrating, high molecular weight, high viscosity? A. That's correct.

Q. Now Mr. Tierney introduced two fractions of G-40, being T-24 and T-24-A. T-24-A, as I remember, was the slightly less viscous portion. Now is that portion of G-40

represented by T-24-A of the resinous type, high molecular weight, non-migrating plasticizer material? A. Yes. May I look at that?

Q. Yes. A. (Inspecting exhibit) Yes, that is a resinous plasticizer.

Mr. Holmes: I think these labels are a little misleading, Your Honor. It is called a liquid. But, then, I won't quarrel over that.

Will you please read the witness' answer back to me?

(The record was read by the reporter.)

Q. (By Mr. Holmes) And does it have the other characteristics I mentioned? [468] A. Yes.

Q. Is T-24-A, or any part of it, of the liquid type, or does it, or any part of it, partake of the characteristics of the liquid type of plasticizer? A. That is not the liquid type as defined here earlier by Oace, or by the custom in the trade. It is a resin plasticizer. It's high molecular weight, it's non-migrating; and we have confirmed those facts with our own fractionations.

Q. Does T-24-A, or any part of it, partake of the characteristics of liquid phthalyl ester plasticizer? A. No, it does not.

Q. Is T-24-A, or any part of it, of the ester type, as that phrase is used in the art and in the literature you referred to? A. T-24-A, as referring to the usage of the trade, is not an ester-type plasticizer. However, I would point out that it does have ester-type linkages, as do practically all the plasticizers, I think, save one, of all types which we have considered in this patent.

The Court: It is, though, of a fluid or liquid type, as distinguished from a powdered product, isn't it?

The Witness: It is liquid in that it is not a solid and is not a gas, but in this patent there is a clear definition—

. . . . . .

[469] The Witness: That's the basic difference between high and low viscosity. The low-viscosity plasticizers run like water; the liquid plasticizers run, as Mr. Tierney said, like water; the resin plasticizers run very slowly, some faster than others, but several hundred times as slow as the liquid plasticizers.

. . . . . .

Q. Now, Mr. Tierney stated that he instructed his laboratory experts or assistants to fractionate off the liquid portion of G-40, and the assistant came up with T-24 and T-24-A. [470] T-24-A being what Mr. Tierney terms, and this label terms, the "liquid fraction," being one-third of the total. I think I have already asked you is T-24-A a liquid plasticizer material, or is there any liquid portion in that material. A. There is no liquid plasticizer, as defined by Otace, . . .

Q. T-24-A is the fraction. If you were asked to fractionate off the liquid material of G-40, which, as I understand it, is what Mr. Tierney asked his assistant to do, would you know what fraction to take off, or would that mean anything to you? A. No, that would be meaningless. If I were saying that a liquid is something which will pour, something which will take the shape of the container, then that would mean I was to take off everything from everything. If the liquid part there refers to a liquid plasticizer, then, of course, those instructions would mean take nothing from this.

Q. Now is what you said as to G-40 true also as to G-25? A. Yes.

Q. That it is a high molecular weight, non migrating, viscous resin plasticizer in all its parts; is that true? A. That's correct.

. . . . . .

[471] A. You understand, Mr. Holmes, that in fractionation you can always take off any sized fraction or any number of fractions when fractionating a resin plasticizer.

Q. So there is no liquid portion in G-25, any more than there is in G-40; is that your conclusion? A. Well, it's a misnomer, for the reasons I have mentioned.

Q. Can a liquid plasticizer be fractionated? A. No.

Q. Could you get off any fraction of G-40 or G-25 which would fall within the category of liquid type, as Once used that phrase and as it is used in the art to which you have referred? A. No. We made attempt to do that by the distillation method, that is, under very high temperature, 260 Centigrade, and very high vacuum, 10 millimeters, which is one seventy-sixth of an atmosphere, the pressure now around us. We tried to distill off from G-40 something that would correspond [472] to a liquid plasticizer. Under those conditions, we had no difficulty in distilling DOP from a mixture of G-40 and DOP; there we could distil it off without difficulty, recover it and identify it. We were not able, under the same conditions, to get one single drop from G-40.

Q. If there had been anything comparable with DOP in the G-40, would it have come off? A. We would have gotten something off.

Q. Do you know about the conditions of manufacture of G-40 and G-25, which would insure no light material? A. I have not seen the manufacture of G-25 and G-40. I am familiar with the manufacture of alkyd resins and alkyd type plasticizers.

. . . . . .

The Witness: I said, sir, that I am not familiar [473] personally with the precise conditions under which G-25 and G-40 are manufactured. I am familiar with the conditions under which alkyd resins generally are manu-

factured, and we heard at Rohm and Haas, and I believe it is in the record, statements as to the methods used at the essential points of manufacture of G-25 and G-40. These details of manufacture were the same as are usual in alkyd resins; that is, the ingredients are heated to high temperature, above 150 Centigrade. The water of reaction goes off. When the acid number is down—you see, here are a great many acids that have to be tied up into a big molecule—when the acid number is down, then it's customary to strip the resin mass under high vacuum and suck off everything that's even remotely volatile. I might say also that this is always done in a nitrogen atmosphere so that oxygen doesn't get in the way. Now Rohm & Haas men stated in my presence—

The Court: Was that when the depositions were taken?

The Witness: Yes, sir.

The Court: Don't put anything in that's not in the record here.

The Witness: I will try not to, sir. When these plasticizers are vacuum-stripped—and I would say from our distillation test of G-40 that it must have been vacuum-stripped, because we subjected it to a drastic condition and [474] could not get a single thing off, under conditions where we could actually distil off DOP. I have the tubes here, if they are of interest.

Q. (By Mr. Holmes) Does T-24-A, which is the less viscous fraction of G-40, have molecules of from 1 to 20 units? A. No.

Q. As testified to by Mr. Tierney? A. Judging from Mr. Tierney's testimony, it might have molecules from 4 to some higher number of units. Actually, and from looking at the viscosities of these samples, I would be greatly surprised if there is as much as one per cent of any resinous material in G-40 that has a molecular weight below 2,000.

Q. Does T-25-A, which was the less viscous fraction of

G-25, have molecules of from 1 to 30 units, as stated by Mr. Tierney? A. Not according to Mr. Tierney's testimony. By simple arithmetic, that fraction could have no units smaller than—could have no fractions smaller than 3 to 4 units, no molecules smaller than 3 to 4 units.

Q. Mr. Kirkpatrick, in his cross-examination of Mr. Tierney, gave 174 as the unit for G-40, instead of 186. Is 186 correct for the unit of G-40? A. Well, I must take the blame for that. 186 is the [475] correct unit for G-40. If I said something else, I had figured it wrong in the hasty computation of the court-room, and perhaps a certain amount of indignation at trying to get some monomer in the picture, which I was quite certain was not present. 186, I believe, is correct, if my arithmetic hasn't faulted again.

Q. Do you remember what it is for G-25? A. I similarly think it is 272, but, in any case, the unit that is found, that is, the thing that corresponds to a monomeric unit in this great, big resin molecule, is one acid, either sebacic or adipic, hooked up at one end to one glycol. That is the basic structure of this unit, and that repeats hundreds of times in order to build up this big general molecule.

Q. In your judgment, is there any possibility that in G-25 or G-40 there is present any material that could be described as a liquid, migrating plasticizing material of low molecular weight? A. No, I believe there is no such material present, and we have confirmed that not only by the distillation test which I just mentioned, but also by fractionating off a lower molecular weight fraction and then making tests of that in tape against pressure-sensitive adhesives to see if that had any [476] of the characteristics of DOP. They had none. Where DOP, under the same circumstances, would stick mightily to the tape, these lower molecular weight fractions of resin plasticizers did not so

stick. They were, however, much easier to incorporate with the vinyl chloride.

[477] Q. Now Mr. Tierney gave the range of molecular weights of G-25 and G-40, from 1000 up. Does that range —is that range consonant with your observed facts? A. I would not question that range of I think from 1000 to 50,000. It sounds reasonable.

Q. Well, the fact that there is nothing lower than a thousand, does that in itself mean that there is no thinly fluid light molecular weight material there? A. That is correct.

. . . . . .

[479] Q. Mr. DeBell, on page 475 of the record of your testimony yesterday, at the bottom of the page, you stated that there was no such liquid migrating plasticizer material in G-25 or G-40 and you had confirmed it by certain distillation tests and also by fractionating off a lower molecular weight fraction and then making tests of that. Were those tests made in tape? Just answer "yes" or "no"? A. Yes, they were made in tape.

Q. And continuing; "Making tests of that against sensitive pressure adhesives to see if they had any of the characteristics of DOP, they had none," you state, and then you continue: [480] "Where DOP under the same circumstances would stick mightily to the tape, these lower molecular weight fractions of the resin plasticizer did not stick". Can you perhaps amplify that a little? Amplify it as to the deductions you draw from the statement you made? A. Yes, the tape which was made entirely with DOP showed so much migration that it was impossible to separate the adhesive tape and the vinyl tape cleanly, whereas when the lower molecular weight fraction of G-25 was similarly used, there was no evidence of migration and the adhesive tape peeled cleanly from the vinyl tape which we had made.

Q. And from that you deduce that there was not—was it G-40? A. G-25.

Q. Any such material as DOP. Is that correct? A. Yes, material which would function in tape like DOP.

Q. Mr. DeBell, on page 179 of the record Mr. Tierney testified that T-24-A, the less viscous fraction of G-40, is: "an liquid ester plasticizer". On the next page he described the more viscous portion of T-24 as "a soft viscous resinous portion". What do you have to say as to his finding one portion of G-40 as "a liquid ester plasticizer" [481] and the other as "the soft viscous resinous portion"?

. . . . . .

Q. Defining one portion of G-40 as "a liquid ester plasticizer" and the other or more viscous fraction as "the soft viscous resinous portion"? A. Well, I'm afraid that is grossly misleading because it would tend to confuse the lower molecular weight resinous fraction of one of these resin plasticizers with the liquid type plasticizer which has been so carefully defined by Oace. Both of those fractions which you mention, are resin plasticizers.

Q. And both are viscous resinous non-migrating high molecular weight resinous plasticizers? A. They are, and they are both capable of further fractionation.

. . . . . .

[482] The Court:

Q. You find fault with that and you say it is grossly misleading. In what particular?—A. Because it tends to confuse the resin plasticizer fractions with the liquid plasticizers. As Oace has clearly pointed out, he deals with a two plasticizer system, a liquid plasticizer and a resin plasticizer. No matter how much you fractionate the resin plasticizer, the fractions are still resin plasticizers and should not be confused with the liquid plasticizers.

. . . . . .

Q. Would you say it was equally misleading to refer to the T-24-A as counsel did on page 180, as "This liquid ester fraction"? [483] A. Well, it is unfortunate because of the same confusion which might arise.

. . . . . .

[486] Q. (By Mr. Holmes) By describing one portion, the portion T-24-A, as a "liquid ester plasticizer," does that description reveal that it is a resinous, soft, viscous resinous high molecular weight plasticizer material? A. No.

. . . . . .

[489] Q. Now is G-40 "a soft and viscous low-acid-number alkyd plasticizer resin," as defined in Claim 1? A. Yes.

Q. Is G-40 a "resinous type plasticizer," as referred to in the Oace patent? A. Yes, sir.

Q. Is it in its entirety a "resinous or high molecular weight modifier such as Paraplex G-25"? A. Yes.

Q. Is it a "resinous modifier," as referred to in the Oace patent in its entirety? A. Yes.

. . . . . .

[490] Q. Now, does the use of DOP, as taught by Oace, mixing it with a resin plasticizer, have advantages? A. It has several advantages. In the first place, the resulting composition is much easier to process, the softening effect of the plastic mass is much better. Where DOP is used the total amount of plasticizer to produce a desired effect is less, and, of course—

Q. Why is that? A. Because the DOP has a higher solvent effect and confers greater flexibility on the polymer; and, of course, DOP has always been a cheaper plasticizer than the resin plasticizer.

. . . . . .

[491] Q. You have referred to certain advantages in the use of DOP, as taught by Oace. Are those advantages supplied by G-40, or any part of G-40? A. No. G-40 has approximately the same viscosity as G-25 in the samples, the random samples, which we have from Rohm & Haas and would present somewhat the same difficulties. It is a little easier to process than G-25, but not as easy to process as it would be if it were mixed with DOP.

Q. And you have to use more of it to get the same result? A. Of G-40 than of a mixture of G-40 and DOP.

Q. When you mix DOP with G-40, let's say, do you change the molecular weights of the molecules of G-40 in any way? A. No, there is no chemical reaction.

Q. Does G-40, because of its average molecular weight of around six thousand, instead of the average molecular weight of eight thousand of G-25, have any of the properties of DOP because of this lesser average molecular weight? A. No. That average molecular weight results from about the same degree of condensation of the molecules when the shorter adipic acid is used in G-40 as against the longer sebacic acid in G-25.

. . . . . .

[493] Q. At pages 149 and 151 of the record—and I will try to paraphrase this—Mr. Tierney testified that . . . if the specification range of G-25 had been narrowed there would be less tendency for higher molecular weight material to exude to the surface; and the elimination of these higher molecular weights would result in less tendency to exude or spew out.

What have you to say to that, Mr. DeBell?

. . . . . .

[494] The Witness: As I recall those remarks and the testimony, that was a speculation that in the early manufacture of G-25 there may have been additional high molecular weight resinous material which was of such high molecular weight that it would account for the effect which Oace speaks of as losing tack, and that the speculation further was that the early material may have had extra high molecular weight ingredients or fractions which were not present in the later material. To check that, we had samples in our stockroom of G-25 produced, first, in 1945; another sample produced in 1951; and current samples of production. We checked the viscosity of those samples both against the bubble tubes and in 50 per cent solution. The viscosity of the earliest sample was the lowest of the lot; the second sample—

[495] Q. That is the 1945 sample? A. The 1945 sample. The viscosity of the 1951 sample was next, and the viscosity of the present day sample was the greatest, although they were all of the same general order of magnitude; and from that it is clear that the speculation that the earlier materials had a very high molecular weight, extra high molecular weight fractions, is not correct. Those samples of the three lots have been included in this set of bubble tubes in the order of the viscosities in which they occur.

Q. Perhaps you will show that to His Honor, if he cares to see it, and what it demonstrates. A. This tube, Your Honor, is a sample of—

The Court: How have you got it designated there?

The Witness: This tube is designated "G-25, Lot 5466," which was made in 1945; "G-25, Lot 12-4316," which was made in 1951; and "G-25, Lot 12-5471," which is the current material which we purchased since this suit started.

[496] (By Mr. Holmes) Were these lots taken at random for your sample? A. They were just what we happened

to have in the stockroom, sir. You will notice, as I turn the tubes, that 5409 is slightly less viscous—

Q. That is the 1945? [496] A. Yes—that 12-4316 is slightly more viscous—

Q. That is the 1951? A. (Continuing)—and the 12-5471 is still more viscous, although in all cases the bubbles rise slowly.

Q. What are the other tubes there? A. While these are rising, the other tubes in this set are, first, a Gardner A standard viscosity tube, which has a viscosity of one-half poise; second, a dioctyl phthalate tube, where the viscosity appears to be of the same order of magnitude; third, a Gardner C tube, which is about six-tenths poise; next a Gardner Z-6 tube, which has a viscosity of 148 poises; next, a Gardner Z-7 tube, which has a viscosity of 388 poises; next the tube of G-25, Lot 5409, which has about the same viscosity, which has a viscosity between Z-7 and Z-8; next a Gardner Z-8 tube, which has a viscosity of 590 poises; next a Gardner Z-9 tube, which has a viscosity of 855 poises; text G-25, Bot 12-4316, which has a viscosity—

Q. What vintage was that? A. That is 1951, which has a viscosity, in my estimation, of around 950 poises; next a Gardner Z-10 standard tube, which has a viscosity of 1060 poises; next a current lot of G-25, Lot 12-5471, which I would estimate to have a viscosity of well over 1060 poises, somewhat over a thousand and sixty- [496a] six poises; and, finally, a current lot of G-40, lot 12-6216, which I would estimate to have a viscosity in the neighborhood of eleven hundred poises.

Q. Did you state what the viscosity was of the 1945 G-25 material? A. I'm not sure, but it appears to be in the neighborhood of four hundred to four hundred and fifty poises. . . . Now we have confirmed these viscosities by other types of measurements in ethylene dichloride solution [497] but the point here is that, from the samples

which we happened to have around, there is no indication that the early vintage of G-25 had substantial fractions of higher molecular weight material which would increase the viscosity.

. . . . . .

[498] Q. (By Mr. Holmes) Do you conclude that there has been no change in the specification range of G-25 from 1945 to date? A. No. I conclude specifically that the speculation that the earlier samples may have had higher molecular fractions than the later samples is incorrect.

Q. And would you conclude that there had been a significant change in the viscosity range of G-25 over the period? A. That, in my opinion, is correct.

. . . . . .

Q. Now, what is polymerized ethyl acrylate? This witness refers to it as a high molecular weight plasticizer material. A. Polymerized ethyl acrylate is the product which is obtained when the monomer, ethyl acrylate, is polymerized to a high molecular weight material.

[499] Q. By polymerizing it to a high molecular weight material, would you in normal process of manufacture, as these things are manufactured, produce a resin type plasticizer? A. Yes.

Q. And would all parts of such product be a resinous type? A. Yes.

. . . . . .

Q. Referring to this ethyl acrylate which he produces he states: "The composition that it has is controllable by [500] the organic chemist, the polymerization chemist tailors it to produce the ethyl acrylate polymer resin of the properties that he wants for the purposes involved". A. That is a correct statement, and the tailoring means by varying the conditions of the polymerization, for example

ple, the concentrations, the method of polymerization, the time, the temperature, the catalyst and other factors, different types of polymer can be produced as desired.

Q. Can the monomers be retained by such a tailoring, with ethyl acrylate? A. If the polymerization is not carried to completion, and if the product is not stripped, there will be monomer in the product.

Q. Now what sort of material is the ethyl acrylate monomer? A. Ethyl acrylate monomer is a volatile solvent. It has a boiling point I believe in the vicinity of 100 degrees Centigrade, about like water.

Q. Does it have a characteristic smell? A. Yes.

Q. Is it like DOP, a monomeric plasticizing material? A. No. It is monomeric but it is not a plasticizer.

Q. What would be the order of molecular weight of the [illegible] ethyl acrylate unpolymerized? Would it be lower than DOP? A. I would say offhand about a hundred, but it's in that book right there. I have not figured it. Reading from the handbook of Chemistry and Physics, the 32nd Edition, Ethyl acrylate is recorded as having a molecular weight of 100.11 and a boiling point of 99.8 degrees Centigrade.

Q. Would that be about like water? A. Yes.

Q. Did you take a piece of tape which Mr. Tierney had had made from this tailored ethyl acrylate? A. I did.

Q. And did you test it, and what did you conclude from your test? A. We took a sample of the tape from the Exhibit here—

The Court: Is that Exhibit 14?

Mr. Holmes: That's right your Honor, Exhibit 14. You have a remarkable memory.

A. I noticed a rather pronounced odor of ethyl acrylate, so we exposed a sample of that tape in an oven at 105 degrees Centigrade, to note the weight loss. We found that there was a very rapid loss within 24 hours, of 35

of the total weight of the tape, which would be of the order of the magnitude of 5%—of 5 parts per hundred of the vinyl chloride polymer used, as I recall that tape described by Mr. Tierney.

[502] Q. What did the odor indicate? A. Well, the odor indicated ethyl acrylate, and the oven test indicated the presence of a substantial amount of a highly volatile material. From that it appears that when taken in conjunction with the testimony as to what this sample T-14 was, that the plasticizing system there was composed of about 45 parts per 100 of a resinous polyester ester plasticizer and about 5 parts per 100 of a volatile solvent.

Q. Would the solvent have any plasticizing effect? A. It is momentarily plasticizing, but it is not a plasticizer because it disappears promptly.

Q. Would it aid in formulating the backing? A. It would aid in processing it.

Q. How would you define this tailored ethyl acrylate? As a mixture of what? A. Judging from the tape sample which we examined, and assuming that that was made from the polyethyl acrylate, and that no ethyl acrylate monomer was added, I would judge that the polyethyl acrylate was a mixture of the resinous polymer with a volatile solvent, the latter in small amount.

Q. Now this tape sample which you took of T-14, would it lose stretch? A. I don't know that we checked that loss of stretch, but it was very inferior to the regular tapes. Regular [503] tapes will stretch readily, 100%. We only had an elongation with this tape of about 55% to 60% when it broke.

. . . . . .

[505] Q. Is G-20 compatible with polyvinyl chloride? A. In ranges useful for flexible composition, no.

Q. Have you tried it? A. Yes.

Q. With what result? A. We tried to prepare samples

of 100 parts of VYNS and 43 parts of G-20. We were not able to prepare films from this combination. The incompatibility is quite obvious when you examine the sample. For the purposes of these tapes, G-20 is a useless plasticizer.

. . . . . .

[507] Q. Now, how about the tape which Mr. Tierney produced which he said was made with the use of G-20 as one of the plasticizing elements? How is that consistent with your statement that G-20 is not compatible with polyvinyl chloride? [508] A. That tape, as I recall it, consisted of 100 polyvinyl chloride resin, 24 G-20 and 24 Dioctyl phthalate. The normally incompatible G-20 was successfully pulled into this tape combination by the use of the excellent plasticizer DiOctyl phthalate. Was it Dioctyl phthalate? It is a well known practice in the vinyl art to use so-called extender plasticizers which in themselves are not suitable for a good product but which can be brought into solution by the use of a substantial proportion of a really good plasticizer, as was done in this case. You will notice also that the 24 parts of liquid plasticizer specified here, carries that tape out of the range of the Oace patent which limits the liquid plasticizer to 20 parts per 100 or thereabouts.

Q. By limit, you mean safe limit. Is that it? A. Yes.

Q. Maximum limit? A. Yes.

. . . . . .

[512] Q. Would the presence of a film of oil on the G-25 plasticizer in your judgment, have any deleterious effect on its utility as a plasticizer for the backing of this vinyl tape? A. No. I would expect it to function as a small amount of additional lubricant to the stearate which is already in the tape.

Q. Did you make tape from the 1945-G-25 as the sole

plasticizer, and with the 1951 G-25 as the sole plasticizer, and with current G-25 as the sole plasticizer? A. We did.

Q. What proportions did you use in each case? [513] A. We used 100 parts by weight of vinyl resin and 43 parts by weight of the G-25. I beg your pardon. We used 100 parts by weight of VYNS and 50 parts by weight of each of the G-25 samples respectively, plus a small amount, 3.5%-3.6% of calcium stearate.

Q. That's the stabilizer? A. As the stabilizer and lubricant.

Q. Now, what results did you observe as to these tapes? A. None of these tapes lost tack when exposed against the pressure-sensitive face of vinyl backed pressure-sensitive adhesive tape.

Q. Over how long a period did you test? A. Initially for a week and now for over ten days.

Q. If there had been a loss of tack it would have appeared in that experiment. Is that so? A. Yes.

. . . . . .

Q. Wait a minute. In making that test were you trying to follow the example 1 of the patent? A. We were trying primarily, sir, to check the statements of column 3, the paragraph beginning with line 45, and column 7, beginning at line 38. The methods used were similar to but not precisely like example 1. We prepared the film in [514] essentially the way they are described, but then we merely rolled that film down against another pressure-sensitive adhesive tape to see what effect the film would have on the pressure sensitive adhesive. In other words, we took from the market a primed tape which had a commercial type of pressure-sensitive adhesive on it, and stuck it on the film which we had made and observed whether there was any loss of tack between the film which we had made, which contained the G-25, and the pressure-sensitive adhesive on the commercial tape.

Mr. Holmes:

Q. Do you happen to know what brand of commercial tape you used? A. Yes. That was from a roll of Plymouth plastic electrical tape which was purchased by me on September 13, 1955.

. . . . . .

[515] Q. Now it was testified, on page 301, that G-40 has "a far larger quantity of lower molecular weight material than is present in Paraplex G-25". Do you agree with that statement? [516] A. Such fractionation and viscosity studies as we have made on the samples we have, do not confirm that. In general we would conclude that the proportions of relative molecular weights and the molecular weights of the products themselves, are not too far apart.

. . . . . .

Q. . . . It was testified on page 264: "That Paraplex G-40 has both the low molecular weight liquid plasticizer present in it, along with the high molecular weight resin plasticizer." Do you agree with that statement?

. . . . . .

[517] A. I do disagree sir. All the fractions of G-40 are high molecular weight resin plasticizers, and they should be so described to distinguish them from the totally different class of materials, the liquid low molecular weight plasticizers. The low molecular weight liquid plasticizer described by Oace in column 3, line 26—

. . . . . .

Q. Now on page 201 of the record, it was testified: "You have some material in Paraplex G-25 that would be identical to DOP in its viscous character." Do you agree with that statement? A. No.

. . . . . .

Cross-Examination.

. . . . . .

[575] XQ. Well, would you tell us how you can have any basis for an opinion as to what is the lowest molecular weight component in either of those? A. That basis arises from several observations. First, that the lowest molecular weight fraction that we have ever seen from our own work or from Mr. Tierney, or anywhere, still is a high molecular weight resinous material whose viscosity is so high, even when it's only 10% of the total fraction, that there is no particular indication of low molecular weight material. Second, I would accept Mr. Tierney's observation [576] that the lowest molecular weight fractions he ever found in G-25 or G-40, had molecular weights of a thousand. Third, if they were low molecular weight materials of the order of molecular weight, for example, of DOP, they should submit to ordinary physical means of removal. Now, we tried to remove such materials, as I pointed out, by high temperature, high vacuum distillation. We didn't get them. We also tried to check them by volatility from films, and again there was no evidence at all of the loss of any low molecular weight material.

XQ. Let's stop there a minute. High temperature, high vacuum distillation is not the way to go about separating these things, is it? A. It is an excellent way to see whether you have any Oace liquid plasticizer or anything like it in the material.

. . . . . .

[578] XQ. So, when you subject such a material to a high temperature vacuum distillation and get out no molecular weight, no low molecular weight material, it just doesn't prove one single solitary thing as to whether it's in there or not, does it? [579] A. Why of course it does.

It proves not only that it isn't there, but by any possible conceivable ester interchange reaction which you could have, that you couldn't even make it. It just proves that it isn't there and there is nothing there from which such a material could be made.

. . . . . .

[585] XQ. (Continued) Now you will notice there that in your answer you spoke about Mr. Tierney saying that there might be molecules of from four to some higher number of units? A. Yes.

. . . . . .

A. The arithmetic there was that if the smallest observed molecular-weight fraction is 1,000, and if the building unit is, let's say, 250, or 270, then the smallest [586] significant molecular size would be 1,000 divided by about 270, which equals 4, approximately.

XQ. So that answer was predicated on the belief that Mr. Tierney had said that the smallest molecular-weight unit in there was 1,000; is that correct? A. My recollection is that there was the remark that he had found molecular-weight fractions from 1,000 to 50,000.

. . . . . .

XQ. Anyhow, it was on the basis of Mr. Tierney's statement, which you have recollected as you just stated, that led you to say that by simple arithmetic there could be no fraction smaller than 3 to 4 units, numerically smaller than 3 to 4 units; that was your basis, wasn't it? A. Yes.

XQ. And your only basis? A. No. That confirmed a great many examinations which I had made of the product, all of which indicated that there is no detectible, at least no practical, amount of low molecular weight material of the order of magnitude of 4 to 5 in molecular weight, let's say, in G-25 or in G-40, which is further confirmed, and you can

readily, by doing [587] some computation on the acid-number, which is a matter of record and specifications.

. . . . . .

[611] XQ. Well, I just want to be sure I understand you. You do take issue then with Dr. Beavers in that statement? A. No. Dr. Beavers says he doesn't know, and I agree with him if he says he doesn't know.

The Court:

Q. If I understand you, you think you do? [612] A. That is correct sir, because I have performed the experiments which are here in the record, which teach me that.

. . . . . .

[613] XQ. I didn't make my question quite as close as I might have. Have you ever added the monomeric portion of G-40—to G-40 and then tried to strip it out by vacuum stripping?

. . . . . .

[614] XQ. Well, I'm talking about your adding what I understood you were calling the monomers, the one that had just one unit in it, not recurring units of the same thing? A. I don't think I referred to it as the monomer. I will now refer to it as a building unit and again define it as the reaction product of either—one molecule of either adipic or sebacic acid, with one molecule of glycol, to form a hydroxy acid which has one ester linkage, and going further to answer your question, I have not prepared that material nor added it to G-25 or G-40.

XQ. And if you did that, according to Flory's equation, you couldn't separate it out by fractional distillation vacuum stripping, could you? A. If I did that I would not be able to separate it by high heat and vacuum because it would immediately react in under the conditions of reaction, to become a high molecular weight material, and that

is shown clearly by contemplation of the acid number of G-25 and G-40 as furnished.

. . . . . .

[615] XQ. Let's come back to your answer of a moment ago where you said if you put some of this single building unit material into the Paraplex G-40 and tried to remove it by high temperature vacuum stripping, you couldn't remove it because it would polymerize. Is that right?

. . . . . .

A. What would happen, it would react.

XQ. It would react and you wouldn't get it out? A. Surely, and that's another reason why there can't be any monomer there.

XQ. Now wait a minute. I don't want us to be pulling [616] ourselves up by our boot straps. I understand that if you put some in and tried to remove it by vacuum stripping, you would not get it out because it would react? A. That's right. You would be making more G-25 and G-40.

. . . . . .

XQ. Well now Mr. DeBell, correct me if I misunderstood your direct testimony, but in your direct testimony I understood that you made a vacuum, high temperature vacuum distillation of Paraplex G-40, and you were unable to get anything out that way, and you therefore offered the conclusion that it had no monomeric material in it. Was [617] that your testimony? A. I offered the conclusion that it had no volatile materials in it in any way comparable to DOP, or more broadly, the liquid plasticizers of the Oace patent.

XQ. Well now, so we don't get mixed up in terminology, you do not consider the monomer of G-40 to be comparable to DOP in your terminology do you? A. Not precisely, because it is the reaction product of two truly monomeric materials, that is, the building block of G-25 and G-40, is

the first reaction product of two monomeric materials, which in this reaction, has only transitory existence.

XQ. Now coming back to your direct testimony that I'm trying to get to, do I understand that all you meant to tell the Court there that was shown by your high temperature vacuum distillation attempt of Paraplex G-40, was simply to prove that there was no DOP in it? A. No. It was to prove that there was nothing of the liquid plasticizer nature in it as defined by Oace.

XQ. But it was not to prove that there was not any of the single unit propylene adipate in it. Is that what you now say? A. It was not to prove that because that I knew already by looking at the acid number.

[618] XQ. You can tell that by looking at the acid number although Dr. Beavers cannot? A. You can compute it. Nobody asked Dr. Beavers about that.

XQ. They asked him whether there was any monomer material in there, and he said he couldn't tell? A. Look at the acid number and you can compute it. Your men can compute that there can't be solitary building blocks in there. That's the ordinary art of alkyd manufacture. When you get the acid number down, the reactants have combined in.

. . . . . .

[625] A. Perhaps I should correct myself. We made the tests on other tape samples earlier by the same method, and we tested samples which were plasticized with G-25 alone, G-40 alone, and a mixture of G-25 and DOP, and a mixture of G-40 and DOP.

. . . . . .

XQ. How did the weight loss compare with the weight loss of the ethyl acrylate sample? A. The weight loss of the G-25 and G-40 samples, as I recall, was under one-tenth of a per cent in the first day. We did not measure in the first

day the weight loss on the mixed DOP samples, but after ten days the weight loss on the resin-plasticized samples was of the order of magnitude of one-half per cent, and the weight loss after ten days of the DOP samples was of the order of five per cent in this test, on a rather constant slope curve, from which we could interpolate that the loss in one day might have been of the order of one-half per cent. So, as nearly as we could tell from our tests, the loss of these three types after one day would be one-tenth per cent on the resin-plasticized [626] samples, perhaps half a per cent on the tapes made according to Oace, and three per cent on the T-14 sample.

. . . . . .

[627] XQ. How many patent cases have you participated in? A. This is the second.

. . . . . .

Redirect Examination.

. . . . . .

[672] Q. On page 596, the first question, have you any comment to make on that and your answer, as reported? A. I evidently missed in the question the remark "which would be somewhat comparable in physical properties to these [673] G-25 DOP mixes we are speaking of." I do not believe, generally speaking, that the conventional ethyl acrylate polymers are somewhat comparable in physical properties to these G-25-DOP mixes we are speaking of.

Q. Are what you have termed conventional alkyd polyesters compatible with polyvinyl chloride? A. No.

. . . . . .

[674] Q. Do you think that migration of plasticizer from the backing into the adhesive would cause, or could cause, loss of tack of the adhesive? A. No. I think it would not cause loss of tack, but, on the contrary, would cause greater

adhesion or even the pasty condition which has been described.

Q. What reason might there be for a loss of tack in the pressure-sensitive adhesive? A. I would expect that that reason would best be sought in the adhesive itself.

Q. You said in those tests of the tape you made to demonstrate loss of weight, or no loss of weight, in the tapes plasticized with such plasticizers as G-25 there was an infinitesimal loss. To what can that be attributed? A. I believe it's due to the absorbed water which many of these materials carry under ordinary atmospheric conditions.

Q. Do most materials carry adsorbed water of that character which would make them lose weight in a test of this character? A. A very small amount of weight, yes. I would expect, for example, that the glass from your eyeglasses would show such a loss.

Q. Reference has been made to the casting method of [675] producing these vinyl backings. Is that a method which does not involve the use of any heat? A. That involves, at the most, very low temperatures, because there the ingredients are put in solution in a solvent, they are floated on a belt or a wheel or a plate, and the solvent is evaporated to leave the film.

. . . . . .

WALTER M. BIERINGER, witness on behalf of defendant, Vice-President and General Sales Manager of Plymouth Rubber Company:

Direct Examination.

. . . . . .

[681] Q. Now you at some time heard of a plastic tape made by Minnesota Mining Company, did you not? A. Yes, indeed.

Q. And about when was that? A. Oh, I imagine from its inception almost; when they started to merchandising to the electrical wholesalers, whenever that was. I would imagine around 1947, maybe 1948, I don't know, around probably 1947, they sent out circulars to all the electrical wholesalers and put on many missionary men, so I was bound to know it right at the start.

. . . . . .

Q. Do you remember what your initial reaction was about that tape? A. Well, my feeling at the very beginning was that it [682] wouldn't go over, that it was far too expensive as compared to friction and rubber tape.

Q. Well, what were the price ranges, in general? A. As I recall it, their material sold to wholesalers in large quantities, I have forgotten exactly, somewhere between 93 and 98 cents a roll for a 63-foot roll; I think I am in the approximate range there, and friction tape was selling at about 22 or 23 cents, and rubber tape, I will say, twenty-something, 25 or 26 cents, so that it was very much more expensive, and for that reason I didn't think that it was going to be successful.

. . . . . .

[683] Q. Now did there come a time when you had a more active interest in plastic tape and in making it yourself? A. Yes.

Q. And about when did that active interest arise and what was the occasion of it? A. Well, after Van Cleef Brothers began manufacturing it I became interested, because Van Cleef Brothers were competitors of ours on friction and rubber tape, which Minnesota was not, and I felt that we couldn't afford to let Van Cleef get in to our customers with this tape, no matter how small the quantities might be, because they might then also get in on the

friction and rubber tape, and it was from that time on that I became interested.

Q. Had you at that time become aware that Minnesota was making quite a go with it? A. I had no way of knowing what their volume was, but I knew they had a fair distribution all right, because many of our customers had it in stock.

[684] Q. Do you remember when it was—I think it's been testified in this case by plaintiff—that Van Cleef came out with theirs? In the last of 1949—does that conform to your recollection? A. I think it was in 1949; I'm pretty sure that was the year.

Q. Well, what did you then do about it? A. Then I got in touch with our factory people and told them I was interested in having them manufacture this product. By that time I had samples to give them, and was informed that they had already done some work on it.

. . . . . .

[685] Q. Now, when you decided to go into this project commercially, did you do anything about the matter of patents? A. Yes. I had seen patent numbers on—I have forgotten whether it was on Minnesota Mining's cartons or on circulars, but I had seen patent numbers, and I asked Mr. Danovitch, in our laboratory, to check on those numbers and see whether or not there was any conflict or any infringement.

Q. Well, did he do so? A. Yes.

Q. And did you instruct him to go to counsel, to take it up with them? A. Yes.

Q. And what was the result? A. Well, I subsequently learned that the counsel had reported that we had not infringed on any of the numbers that were checked.

Q. Did Mr. Danovitch give you the report rendered by counsel? A. Yes, he did.

Q. Is this the report that was given to you by Mr. Danovitch? A. Yes.

. . . . . .

[693] Mr. Kinney: The witness has testified about what Mr. Danovitch told him that the attorneys said.

The Court: Well, I will exclude that part of it.

Mr. Kinney: That is hearsay.

. . . . . .

A. Excuse me, I didn't finish that last answer entirely. In addition to what is evidently being excluded, I also telephoned long distance to Van Cleef Brothers to ask them if they knew of any patents, and they said—

. . . . . .

A. They said in their opinion there was nothing to worry about on the patent angle.

. . . . . .

[694] Q. (By Mr. Holmes) When did you first hear that a patent had issued to Minnesota Mining which had to do with this plastic tape, Mr. Bieringer? A. I believe it was in 1951, the fall, I believe, of 1951. It may have been in September or October of that year.

Q. And what was the occasion? A. I was asked by the Boston office of Minnesota Mining whether or not I could see two of their officials if they came to Boston, and it was on that occasion I had lunch there with their Mr. Halpin, I believe it was, their Vice-President, and Mr. Westbee. We had lunch at the Ritz Carlton Hotel, and during that luncheon Mr. Halpin pulled this patent out of his pocket and asked me if I had seen it. I said that I had not, knew nothing about it, and that was the first time that I had any introduction to it.

Q. Have you identified that as what we have termed the original Oace patent in suit? [695] A. Yes, that's correct.

Q. Did Mr. Halpin make any observations about the patent? A. Yes. He said he didn't know if it had any value or not, but if they should decide that it had value at a later date, would I be perhaps interested in sitting down with them and discussing some license arrangement.

Q. What was your comment on that? A. I told them if it were to the advantage of our company we certainly would discuss it.

Q. Did Mr. Halpin make any charge or suggestion that you were infringing this patent? A. No.

Q. Now this suit was brought in August, 1954—is that correct?

. . . . . .

Q. Now between that time, when you met Mr. Halpin at the Ritz Carlton Hotel, that you have just referred to, and August, 1954, when this suit was brought, did you have any other meetings with representatives of the Minnesota Mining Company? A. Yes, on two occasions I remember during electrical conventions receiving telephone calls from either Mr. Westbee or Mr. Halpin. I don't remember which one telephoned me, [696] but they wanted to see me. On one occasion I believe it was in Atlantic City; the other one I am positive was in Chicago. Then on a third occasion they asked to see me and came to my office at our factory in Canton, Massachusetts.

The Court: About what date was that that they came to see you?

The Witness: It was all prior to the bringing of the lawsuit. I don't remember whether it was 1952 or 1953.

Q. (By Mr. Holmes) Did you speak of meeting them at the electrical convention at Atlantic City? A. Yes.

Q. And the occasion of their coming to Canton? A. And in Chicago.

Q. And what, in general, were the subject-matters discussed at those conferences? A. Well, their chief interest was that we should get our prices up, particularly in one instance they wanted us to raise our prices to meet theirs in the case of a very large public utility—

. . . . . .

[697] Q. (By Mr. Holmes) Was any further mention made of this patent to which you referred at any of these later meetings with representatives of the Minnesota Mining? A. No, at no time.

Q. Did they, or any of them, ever charge you with infringement of the patent? A. No, sir.

Q. That is, until suit was filed? A. Yes. Prior to the suit, no mention was made of it.

. . . . . .

Redirect Examination.

. . . . . .

[702] Q. I neglected to ask you, Mr. Bieringer, when you were handed at the Ritz, at that first conference, when you were handed the patent in suit, the original patent, what did you do with it? A. I took it down to the factory the next day when I went out there and handed it to Mr. Hamilburg, our President.

Q. Do you know what he did with it? A. Yes, he sent it to our regular attorneys.

. . . . . .

FRANK L. KOZOL, witness on behalf of defendants, of Friedman, Atherton, Sisson & Kozol, General Counsel of Plymouth Rubber Company:

Direct Examination.

. . . . . .

[703] Q. Did you at some time, consider and take up the matter of insurance, patent insurance, and will you tell us the circumstances and when you did that? [704] A. I did take up such a subject matter sir. It was in the very late summer or in the early part of September, 1950, and it occurred in my office.

Q. Well, what was the occasion of your doing that? A. The President of the Plymouth Rubber Company, Mr. Joseph M. Hamilburg, came to visit with me by appointment, and on that occasion he directed some inquiries to me. We had a conference and a long discussion. On that occasion he told me that the company was about to embark on the manufacture of a plastic tape which had been developed by the company's chemical department, that the Minnesota Mining and Manufacturing Company had manufactured a plastic tape and that it had been brought to his attention somewhere a patent number or numbers were indicated, and that he had requested an opinion from patent counsel for the company, namely, Fish, Richardson and Neave, that he had that opinion with him, and he displayed it to me. I read the opinion. I then said to him: "I would not want any better opinion, because you know as I've told you—

. . . . . .

[705] A. I told him I would not want any better opinion. I reminded him that some years before when I first sent the company to Fish, Richardson and Neave, that I characterized them as one of the great leading patent firms of this country, that I had implicit confidence in their stature and ability, I was perfectly content to be guided in this field by their judgment. He then said to me—

Mr. Holmes:

Q. The opinion, I take it, that you were not infringing? A. The opinion was that indeed. He then said to me that he did not want to have any difficulty and if there were any questions whatsoever, he would just simply refrain from having his company go into such a situation like that because the Minnesota Mining people had a reputation throughout the country to be quick to sue, that they employed tactics of harrassment—

. . . . . .

[707] A. Well, I then asked him whether he was intent upon going forward with the manufacture of this product, being assured by the opinion of Fish, Richardson and Neave that there was no infringement with the Minnesota Mining, and he said he was, he was a little disturbed lest the Minnesota people sue some of his customers. I told him that if he was prepared to rely upon the opinion of Fish, Richardson and Neave as I was, and I so advised him, to go forward and to manufacture his product, and I said to him: "I would suggest also, as a matter of abundant precaution, that you check into the cost of patent liability insurance." He asked me to do that for him and to report to him, which I did.

. . . . . .

[709] Q. And did you find that for a very small amount you could be insured against liability for yourself and customers? A. That is right.

Q. In damages? A. That's right.

Q. And did you thereafter, through my firm, make a very [710] extensive search to see if there were any patents you might possibly be infringing? A. I made that request and received a reply.

Q. Was that a search that cost several hundred dollars? A. Yes sir.

The Court:

Q. What date did you get your reply? Do you have your correspondence? A. I don't have that sir.

Mr. Holmes: I have the letter that our firm states we studied some seventy-three patents.

The Court: I was merely trying to fix the date. He said he had a report from you.

A. Some month after August but I don't recall the month.

Mr. Holmes: February 20, 1951.

Mr. Holmes:

Q. And you were advised that no other patents had been found that you were infringing? A. That is correct sir.

Q. When the Minnesota patent came out, at some time after the Minnesota patent came out, was that patent referred to you by Mr. Hamilburg? A. In the midsummer of 1951 there was referred to me.

Q. Might it not have been the Fall, because the opinion we have is in October. [711] A. Well, my recollection is upon my return from my vacation that year, which I think was in late August or early September, I don't recall exactly, but it was in that period of time.

Q. If I told you that our opinion as to that was rendered on November 6, 1951, would that refresh your recollection as to when this patent was called to your attention? A. Well, obviously it was sometime prior to that.

Q. Well, would it be very shortly prior to that? A. I should think so, sir.

. . . . . .

Q. Were you advised that you were not infringing? A. I was.

Q. Now, did you at some time—the patent in suit came out in July 1951—did you at some time discontinue the insurance? A. Yes sir.

. . . . . .

[712] Q. And what was the date? A. October, 1953. The specific date I don't know.

Q. Did you write the company that you were discontinuing and "no claims of any type are anticipated"? A. I wrote that sir.

Q. What was the occasion of your discontinuing even this small insurance payment? A. That followed and was consonant upon a conference I had with the President of the Plymouth Rubber Company, and on that occasion I discussed the insurance situation with him. I indicated my judgment, that even though the inusrance premiums were not large, not excessive, I didn't think it made much sense to continue it because if there was any concept of possible infringement, surely we would have heard from the Minnesota Mining people before now, and under those circumstances I thought it no sense to spend any further money on insurance premiums, and advised that it be discontinued, and the President of the company accepted my advice.

Q. And in that conference did you have in mind that you had been advised you were not infringing? A. I discussed that with Mr. Hamilburg and predicated part of my judgment on that advice.

. . . . . .

Cross-Examination.

. . . . . .

[714] XQ. Well how could you happen to recommend that they take insurance? A. Well, I said to Mr. Hamilburg, that nobody could be so all-wise or all-knowing even with the ablest legal opinion obtainable, and that it might make sense out of an abundance of precaution, to get insurance if it didn't cost too much, just as I insure my house for full

value although it can't be burned down because it's brick and tile.

. . . . . .

[715] XQ. Well, it was just on an off chance that there might have been an infringement. There wasn't any question of an infringement of the patent in suit at that time, definitely? A. Of course not. The patent in suit wasn't existent then.

XQ. Now was there a search made beyond the search that was made by Fish, Richardson and Neave with respect to these patents that were existing before the patent in suit issued? A. There was another search made by another patent firm.

XQ. When? A. When I came to arrange for the insurance.

XQ. You mean there was an independent search made that you had to provide in order to get this insurance? A. There was an independent search made, yes sir.

. . . . . .

[716] XQ. The second report we're talking about? A. Oh. They too made what they represented to be an exhaustive search, in such manner as patent lawyers do it, and reported to me their complete satisfaction that there was no infringement between Plymouth's product and anything covered by the patents that they had found.

XQ. Rather broad wasn't it? A. Yes.

XQ. Who was that firm? A. Kenway, Witter—it's a long name. Kenway, Witter is the way we refer to it in Boston, an eminent patent firm.

. . . . . .

Excerpts from Deposition of Morris M. Danovitch, Taken by Plaintiff at Boston, Massachusetts, February 9-16, 1955.

Deposition of MORRIS M. DANOVITCH, witness for plaintiff, chemist, in employ of Plymouth Rubber Company, since July, 1924:

Direct Examination.

. . . . . .

[13] Q68. I think you said, Mr. Danovitch, that you commenced on this development in the year 1948. Do you remember whether that was early in 1948 or late in '48? A. No. It was late '48.

. . . . . .

Q77. Well now, what did you use as a guide when you started [14] in '48 on that tape? A. What did I use as a guide?

Q78. Yes. Anything? A. Oh, just the knowledge that I acquired from my experience on my work with plastics in other lines, and also in peroxyllins. I at one time handled all our peroxyllin coating materials, so I was familiar with plasticizers and resins, and I had a pretty general knowledge of the trade at the time.

. . . . . .

[23] Q144. Well now, when you started working on this project of making this pressure-sensitive, stretchy, retractable, [24] vinyl chloride insulating tape, didn't you at least have the "Scotch" electrical tape of commerce to guide you? A. We had some "Scotch" tape but not to guide us. Just to look at.

. . . . . .

[29] Q194. Do you know anything about the chemical nature of Paraplex G-40 by word of mouth or otherwise? A.

No, not too much chemically. I only know what it will do and what it does.

. . . . . .

[32] Q214. Were those two different ingredients a polyester type material and a liquid material? A. In some cases.

Q215. And in some cases was one of the ingredients Paraplex G-25 and the liquid ingredient dioctyl phthalate? A. Yes. But in every case the amount of liquid plasticizers was a very small minute part.

. . . . . .

[39] Q252. We are not talking about your commercial product at the moment. Some of these sample rolls that you made up in the laboratory in the 1948 to 1950 period when put in the oven for the 24-hour aging test at 100 degrees C., some of them went gooey? A. That is right.

Q253. Now did you have any understanding of why they went gooey? A. Yes.

Q254. What was your explanation of that? A. It was due to the liquid plasticizer.

Q255. And due to it doing what to what? A. Migrating, coming out from the plasticizer into the rubber. Coming out from the plastic film into the rubber adhesive. In other words, I found that DOP would do that and tricresyl would.

Q256. Did you find they would do that even if present only in small proportions? A. Yes.

. . . . . .

[41] Q269. The pressure-sensitive adhesives then that are used commercially are bought by Plymouth Rubber? A. That is correct.

Q270. And does your supplier give you the formulation of those adhesives? A. No, sir. I don't know what he uses.

. . . . . .

[51] Q345. About what proportion of your time during that two-year period would you estimate was devoted to this plastic tape project? A. Not too much.

Q346. 5%? A. Maybe 5 or 10%.

. . . . . .

[254] Q829. Did you have any analysis made of the Minnesota Mining tape then on the market? A. No.

Q830. Did you make an analysis of it? A. No. We had no way of making any analysis in our laboratory. We haven't the equipment.

Q831. Did you or your company have the product analyzed on the outside then? A. No, sir.

Q832. Did you at that time know that the "Scotch" Brand No. 33 electrical tape was made with a polyvinyl chloride [255] backing? A. Yes.

Q833. Did you know that the backing contained a plasticizer material? A. Yes. Couldn't make any vinyl. That is just natural.

Q834. Did you know what the plasticizer material was at that time? A. No, sir.

Q835. Did you sometime later learn what it was? A. No. Only until after the patent came out.

Q836. Which patent? A. Your first one there.

. . . . . .

[383] Q1369. Now did that tape turn out all right? A. No, that did not.

Q1370. What difficulty did you have with that? A. We got migration due to pastiness of adhesive.

Q1371. Your adhesive became pasty? A. Yes. Which I attribute to the addition of the DOP.

Q1372. Do you have any test data that shows that? A. No, because anything that was bad I didn't ordinarily keep. I had no interest in it.

Q1373. No test data to show that? A. No.

Q1374. You know very well that Minnesota Mining's production for years had DOP in it as well as a polyester plasticizer and was perfectly satisfactory tape, don't you? A. Well, so it said in the patent that came out in late '51.

Q1375. You made formulations up according to that patent, didn't you? A. I did not.

Q1376. You have never done that? A. I did not. In fact, in my early work that patent wasn't even out.

. . . . . .

[386] Q1398. Yes. Read it all in. A. "T-345. 33 in a circle. Mixed 2/29/52. 7 minutes high, 8 minutes low. Temperature 325 degrees. Looks softer than regular and not so dry. Stuck to mill in mill room." I don't know what that last figure is. "Added one pound calcium stearate and was better. Send out to No. 5. Stuck to feed mill and then when started to calender had all kinds of trouble. Calender at time 340 degrees F. Took two hours to get going again second time. Have had trouble with G-25. Top side was smooth. Under side rough rough as hell. Something rotten in Denmark." I recall this particular one. I had a lot of trouble with it.

. . . . . .

[416] Q1587. Now do you know why this G-25, when used alone or in high proportion or without the presence of DOP, caused [417] some difficulty in calendering?

Mr. KIRKPATRICK. Are you still talking about that period of that document, February 6, 1952?

Mr. KINNEY. Yes. That time or earlier.

A. No, I don't. We never were able to calender G-25 successfully as a film.

Mr. KIRKPATRICK. In that period?

The WITNESS. During that period. As my own records show.

. . . . . .

Cross-Examination.

. . . . . .

[535] XQ2161. Then, as I understand it, those liquid plasticizers, dioctyl phthalate, tricresyl phosphate or whatnot, tended to make easier the mixing or dispersal in the resin, but you were not able to use them in your adhesive tape work because of migration troubles with the adhesive on the plastic tape? A. Yes. My work showed that wherever I used these liquid plasticizers I got migration of the plasticizer.

. . . . . .

[556] XQ2239. Is it true, Mr. Danovitch, that it was always difficult and still is difficult to some extent at least to run [557] your regular G-40 tape material? It requires some machine tricks and the like? A. Yes, to a certain extent.

XQ2240. And in that respect has it been your experience that G-25 has been still harder to run, at least up to May of 1954? A. Yes. My experience prior to that was we were never able to run G-25.

XQ2241. Now what enabled you to run that G-25 successfully? I hand you Exhibit 18 for identification in this connection [indicating]. A. The only reason we could run this was we found a lubricant which helped us to get this off the calender.

XQ2242. Would you have been able to run it without that lubricant? A. No.

XQ2243. That particular lubricant you have indicated is this 407 wax appearing on Exhibit 18 for identification? A. Yes.

. . . . . .

[558] XQ2244. Had you always had trouble with G-25 prior to the time of incorporating 407 wax therewith? A. Yes.

XQ2245. Were you able to run anything satisfactorily with G-25 alone? A. No, we were never able to.

XQ2246. And that was true up until May of 1954? A. Yes.

XQ2247. Now what was the reason for developing this formula, Exhibit 18 for identification, incorporating the wax and the G-25, the G-25 being the sole plasticizer? A. That was for the purpose of meeting new government specifications on plastic tape that was out.

XQ2248. And would your G-40 tape meet that new Government specification? A. No. There were certain requirements in the specification where our regular production would not meet it.

. . . . . .

Redirect Examination.

. . . . . .

[580] Q2353. Who suggested the use of that wax? A. My best recollection is it came from a salesman.

. . . . . .

[590] Q2396. Now I understood you to say, in answer to your counsel's questions, that you found that liquid plasticizers tended to make the adhesives go pasty? A. That is correct.

Q2397. You were referring to the liquid plasticizers when used as the sole plasticizer for the vinyl resin, is that right? A. No. I was referring to when it is used in combination.

Q2398. Well, was it your intention to generalize and say that a liquid plasticizer, when used in combination with other plasticizers, will nonetheless make the adhesive coating pasty? A. That has been my experience right along.

. . . . . .

Recross-Examination.

. . . . . .

[600] XQ2448. As a final question, is it correct to say that a given batch of any given formulation could succeed or fail in actual commercial production depending on how it is handled by the, we will say, Banbury and the milling and the calender people? A. Yes.

. . . . . .

Excerpts from Plaintiff's Exhibit 2—File History of the Original Oace et al. Patent in Suit No. 2,559,990.

Original Claim 3

[Ex. 2, p. 17:]

"3. A stretchable and elastic pressure-sensitive adhesive tape adapted for use as an electrical insulating tape for wrapping wire and cable splices, comprising a film backing compounded of a vinyl chloride polymer blended with a low molecular weight liquid plasticizer in amount not exceeding about 20 parts per 100 parts of the vinyl chloride polymer and a non-migrating high molecular weight plasticizer imparting additional elasticity, and a water-insoluble and non-corrosive normally tacky and pressure-sensitive adhesive coating firmly united to the film backing, the adhesive coating and backing film being in permanent equilibrium so that the adhesive is stably tacky and eucohesive, and the adhesive tape being stretchable to the extent of at least about 50% at room temperature and being substantially completely retractable from an elongation of 30%."

Excerpt from Patent Office Action of March 4, 1947.

[Ex. 2, pp. 22-23:]

"Claims 3, 6, 7 and 8 are rejected as involving no invention over Morgan or Eustis in view of Robertson and Groff. The primary references teach that a vinyl resin film may be employed as a backing for a pressure sensitive adhesive base. Obviously to modify such base with plasticizers, pigments, stabilizers or the like would involve nothing patentable, especially since the secondary references

show that vinyl resin films may have different physical characteristics dependent on the modifying agents included in the film.

"Claims 3, 6, 7 and 8 are further rejected as failing to properly define the invention as required by R.S. 4888. The term 'vinyl chloride polymer' is too broad since it includes all polymerized resins which may include some vinyl chloride. The disclosure does not warrant such broad protection. The description of the plasticizers as being 'a low molecular weight liquid plasticizer' and 'a non-migrating high molecular weight plasticizer' fails to define what these plasticizers are but relies simply on the single detail of having low or high molecular weights. This limitation is valueless in defining the actual substances employed. The statement that the adhesive is in permanent equilibrium with the film backing sets forth nothing more than a desired result since it fails to include sufficient details to show how this permanency is obtained."

Excerpt from Patent Office Action of May 11, 1948.

[Ex. 2, p. 33:]

"Claims 3, 4 and 6-9 are rejected as unpatentable over Morgan or Eustis in view of Robertson and Groff for reasons set forth against claims 3, 6, 7 and 8 in Paper #2a. The claims of this application set forth an adhesive tape having desired characteristics which are imparted thereto primarily by the use of plasticizers which are old for plasticizing vinyl resin films. No invention is seen in applying an adhesive coating to a vinyl resin film which is modified in accordance with the teachings of the prior art. Although applicants argue that they have attained commercial success with their product, it is not seen that this argument

is convincing since the claims do not define patentable subject matter. See In re Normann et al, 150 Fed. (2nd) 708; 66 U.S.P.Q. 308."

EXCERPT FROM AMENDMENT OF NOVEMBER 8, 1948.

[Ex. 2, pp. 34-35:]

"Please cancel claims 1 to 9, inclusive (all of the present claims) and add the following claims:

"1. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprised of: a stretchable and elastic film backing having a thickness of 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of a film-forming polymer of monomers including at least a major proportion of vinyl chloride, a substantially non-volatile liquid phthalyl ester plasticizer amounting to 8 to 20 parts per 100 parts of said polymer, and a soft and viscous low-acid-number alkyd plasticizer resin in amount at least equal to the amount of said liquid phthalyl ester plasticizer, the total amount of said plasticizers being about ⅓ to ½ the amount of said polymer and the proportions being such that the adhesive tape has the properties of stretch and elasticity hereafter specified without causing pastiness or tack-loss of the contacting adhesive in the roll; and a eucohesive normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing; said adhesive tape being unwindable without delamination or offsetting of adhesive, being originally stretchable by hand-pulling to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30% as herein specified."

[This claim as amended became claim 1 of the issued patent.]

EXCERPT FROM APPLICANTS' REMARKS, ACCOMPANYING AMENDMENT OF NOVEMBER 8, 1948.

[Ex. 2, p. 41:]

"The *Robertson* patent relates to an alleged novel technique for making vinyl resin films. Beginning with line 63, col. 2, page 2, reference is made to plasticizers. These plasticizers may be used 'in any amount up to about 20% or somewhat more based on the weight of the vinyl resin'. There is no suggestion of the three-way blend used by applicants, employing the vinyl chloride polymer, the liquid phthalyl ester, and the alkyd resin, *combined together*. That this three-way blend is essential to the success of applicants' product was clearly pointed out in the application as filed. Thus on page 2 it was pointed out that the phthalate plasticizer used alone resulted in inadequate stretch and elasticity, particularly in respect to backings of the thickness used in electrical tapes. If the plasticizer proportion is increased, the film becomes unsuitable because it makes the adhesive become soft and pasty. On the other hand, the resinous type plasticizer, if used alone in sufficient amount to impart desirable physical properties, results in the adhesive losing its tack (top of page 5). Obviously this Robertson patent does not teach applicants' discovery—first because it does not disclose their backing film, and second because it teaches nothing about the problems of pressure-sensitive tape backings."

EXCERPT FROM APPLICANTS' REMARKS ACCOMPANYING AMENDMENT OF NOVEMBER 4, 1949.

[Ex. 2, p. 54:]

"As was pointed out in the interview, claims 10 and 12, together with dependent claims 11 and 13, are clear and definite with the amendments here presented. Soft and

viscous alkyd resin is shown in the specification to serve as a plasticizer for the vinyl chloride polymer, and adds properties thereto which are not made available by a mere increase in the proportion of liquid phthalyl ester plasticizer. (The reverse is also true, as is apparent from the specification.)"

EXCERPT FROM PATENT OFFICE ACTION OF MAY 24, 1950.

[Ex. 2, p. 56:]

"Claims 10-13 are further rejected as too broad as to the description of the base material. It is obvious that the particular type of vinyl resin used in combination with controlled amounts of specific plasticizers are factors which go to the essence of the alleged invention and should, therefore, be specifically defined in the claims. Applicants have indicated in their specification that specific plasticizers are required to produce their insulating tape having certain desired properties of elasticity. The use, therefore, of the broad expressions 'a liquid phthalyl ester' and 'a soft and viscous alkyd resin' are objected to as unduly broad."

EXCERPT FROM APPLICANTS' REMARKS ACCOMPANYING AMENDMENT OF OCTOBER 12, 1950.

[Ex. 2, p. 60:]

"Additionally, it should be noted that the claims require the tape backing to be formed of a *homogeneous* mixture of a *stable blend* of the components having *stated proportions.* These requirements, together with the stated requirements as to the individual components, effectively and adequately define the tape product in terms which fully distinguish over the prior art."

Excerpts from Plaintiff's Exhibit 4, File History and Contents of Reissue Patent in Suit, Re. No. 23843.

ORIGINAL CLAIM 7.

[P. 15:]

"7. As a new article of manufacture a pressure-sensitive adhesive insulating tape comprising a high di-electric strength, water-insoluble and hydrocarbon oil insoluble backing film from 4 to 20 mils thick comprising a stable film-forming blend of polymer material and plasticizing material therefor sufficient to produce a film which in the above thicknesses is stretchable by hand pulling to an extent of at least 50% at room temperature and substantially completely retractable from an elongation of at least 30%, and a water-insoluble pressure-sensitive adhesive coating on one side of said backing film, the plasticizing material of the backing film being selected with respect to the polymer material thereof and with respect to said pressure-sensitive adhesive so as to avoid causing said adhesive to become pasty or to lose its tackiness upon prolonged and intimate contact thereof with said backing film, said insulating tape being capable of being formed into rolls or stacks of superimposed, contiguous layers thereof and subsequently removed therefrom without damage to the backing or offsetting of the adhesive."

EXCERPT FROM INVENTORS' OATH ACCOMPANYING REISSUE APPLICATION.

[Pp. 22-23:]

"Deponents failed adequately to explain to their attorneys the nature and characteristics of the materials described in the specification, and the relationship of the characteristics of said materials to each other, from which

the actual scope of the invention may be determined, and the importance of the details thereof. Each and all of the Deponents were virtually without any prior experience in connection with patents at the time of their original application. In interviews had within the last month, it became apparent to Deponents that their invention was not sufficiently or adequately claimed, within the scope of the inherent qualities of the illustrative embodiments of their invention, and that the claims of their original patent therefore were not sufficient to adequately cover their invention. In particular, it became apparent that Deponents themselves, upon a reading of the specification, could readily suggest how to evade the scope of each of the claims, while making the product defined in their patent."

EXCERPT FROM PATENT OFFICE ACTION OF AUGUST 7, 1952.

[P. 27, par. 6, 1st sentence:]

Claims 6 to 14 inclusive are rejected as being too broad and indefinite, and as failing to comply with Section 4888 of Revised Statutes. The expressions "film-forming blend of polymer material" (claims 6, 7, 13, 14), or backing "having the vinyl linkage" (claim 8) do not specify any particular type of materials; the application discloses only certain particular copolymers of vinyl chloride.

AMENDMENT OF MAY 12, 1953—ADDITION OF NEW CLAIM 16, WITH AMENDMENTS. (THIS CLAIM BECAME CLAIM 6 OF THE REISSUE PATENT.)

[Ex. 14, p. 58:]

6. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprising: (1) a water-insoluble and hydrocarbon-oil-insoluble film backing of high

dielectric strength containing a stabilizer and having a thickness of 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of (a) a film-forming polymer of monomers including at least a major proportion of vinyl chloride, and (b) a substantially non-volatile plasticizing material therefor in an amount within the range of at least ⅓ the weight of said polymer but in a substantially lesser amount than said polymer and comprising at least a major proportion of a non-migrating viscous plasticizer resin, and the proportions being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contacting adhesive in the roll; (2) an adhesive primer coating on the inner face of the film backing adapted to increase the anchorage of the adhesive coating; and (3) a water-insoluble normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing, over said primer coating, said adhesive coating being thin in relation to said film backing; said film backing being in permanent equilibrium with said pressure-sensitive adhesive coating so as to avoid pastiness or loss of tack of the said adhesive coating and diminution of the flexibility of said film backing; said adhesive tape being unwindable from the roll without delamination of the tape or offsetting of the adhesive, being originally stretchable in widths not greater than about one inch by simple hand pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30%, as herein specified; said tape being readily conformable to irregular surfaces in insulating wire splices and its elasticity, retractability and high adhesion value making it easy, in insulated splices, to produce snug wrappings and coverings, and said tape having sufficiently aggressive ad-

Defendant Ex 12 4

Period Ending
May 15, 1944

TO: DR. H. N. STEPHENS

Research Department
Adhesive Section

SEMI-MONTHLY REPORT

* * * * * * * * * * * (Page 4)

AR42 - Elastic Plasticisers - Dr. W. E. Lundquist and Esther Eastwold

Work is under way in the evaluation of polyvinyl chloride films which have been plasticised with a number of commercially available plasticisers. First evaluation of interest is that which concerns the possible migration of plasticiser to the adhesive. Tests were started in which samples of each acrylate, alkyd, and rubber cellophane tape were placed in contact with the plasticised

(Page 5)

films for the purpose of determining adhesion and effects on the adhesive after stated intervals of time. In the majority of the cases the adhesion was so high that the adhesive either stripped from the backing or the film-tape combination could not be held down to the glass plate with double coated tape. Consequently, the films have been coated with each the rubber adhesive and the acrylate adhesive and the adhesion tests will be made from strips cut from these coated films. Observations will also be made for the development of stringiness in the adhesive.

/s/ J. O. Hendricks 5-23-44
Adhesive Research Laboratory

Period Ending
July 15, 1944

TO: DR. H. M. STEPHENS

Research Department
Adhesive Section

SEMI-MONTHLY REPORT

* * * * * * * * * * * (Page 3)

AR42 - Elastic Plasticisers - Dr. W. E. Lundquist and Esther Eastwold

One group of tests of different adhesives coated on various plasticised polyvinyl chloride films is nearing completion. The alkyd and Vistanex adhesives appear undesirable in that the

(Page 4)

former has too low adhesion and the latter becomes pasty and stringy. Better results have been obtained with bakelised acrylate, natural rubber, and GR-S base adhesives. From the tests of adhesive strips against their own backings, Paraplex G25 as a plasticiser has shown up well. The strips were held at 120 and 150°F. for a period of one week. The plasticizer may affect the adhesive, but rather than causing the latter to go pasty, it becomes drier and has less tack.

* * * * * * * * * * *

/s/ J. O. Hendricks 7-21-44
Adhesive Research Laboratory

Period Ending
July 31, 1944

TO: DR. H. M. STEPHENS

Research Department
Adhesive Section

SEMI-MONTHLY REPORT

* * * * * * * * * * (Page 4)

AR42 - Elastic Plasticisers - Dr. W. E. Lundquist and Esther Eastwold

The series of tests described previously have now been

(Page 5)

completed. The Vinylite VYNW (Carbide polyvinyl chloride) was plasticised with each of Paraplex G25, tricresyl phosphate and dioctyl phthalate. On each plasticised film the following adhesives were coated: Vistanex, alkyd, bakelised acrylate, Buna S and rubber. The adhesive coated films were left in contact with their own backing over a period of time at room temperature, at 120°F., and at 150°F.

The alkyd and Vistanex adhesives gave poor results with each of the plasticised films. The softening effect of the various plasticizers on the adhesives listed in decreasing order was dioctyl phthalate, tricresyl phosphate, and Paraplex G25. PG25 caused splitting of the bakelised acrylate and a reduction in adhesion of the Buna S adhesive. The rubber adhesive on the PG25 plasticised film remained in fairly good condition but there was a reduction in wet grab and the anchorage was not too good. In general, the effect of higher temperature was to speed up the phenomena occuring at a slower rate at room temperature. From the results it is seen that PG25 is the best plasticizer to use with respect to least harmful effects to the adhesive. Apparently, this plasticiser is less compatible with polyvinyl chloride than either TCP or DOP, since the tensile strength of its plasticised film was lower than either of the films plasticised by the others.

The results showed that the possibility of obtaining a mending tape having a DOP plasticised film as the backing was not very good on account of the effect of the plasticisers on the adhesive. The alkyd adhesive was least effected by this plasti-

Defendants' Exhibit 6

268 5

4-4-46

Prep of films for obtaining tensile & sketch data

30 g of solution used in each of following

1	XYNL - RB2	(80:20)	(7.5g XYNL)	1.88g RB2	
2		(82:18)		1.65g RB2	
3		(85:15)		1.33g RB2	
4	VYNS - RB2	(85:15)	6.9g VYNS	1.22g RB2	
5		80:20		1.73g RB2	
6		75:25		2.3 g RB2	
7		70:30		2.96g RB2	
				BKO	DOP
8	VYNS-BKO-DOP	(85:5:10)	6.9g VYNS	.41g	.81
9		(82:10:8)		.84g	.67
10		(80:10:10)		.87g	.87
11		(85:10:5)		.81	.41
14		80:15:5		1.13	.375
12	VYNS - BKO	(83:17)	6.9 g VYNS	1.42 g BKO	
13		(80:24)		1.73 g BKO	
15	Gen 216-DOP-BKO	(80:5:15)	6.g Gen 216	.375 g DOP	1.13g BKO
16		(84:8:8)		.57g DOP	.57g BKO
17	Gen 216-BKO	(80:20)	6g Gen 216	1.5 g BKO	
18		(77:23)		1.8 g BKO	

Cast on glass plate, dried in 65° C oven over nite
#6 & 7 are sticky - emulsion, 4,5,6,7 are somewhat opalescent & whitish.

4 VYNS - RB2 (85:15) 6.9 g VYNS 1.22 g RB2
5 80:20 1.73 g RB2
6 75:25 2.3 g RB2
7 70:30 2.96 g RB2
BKO DOP
8 VYNS-BKO-DOP (85:5:10) 6.9g VYNS .41g .81
9 (82:10:8) .84g .67
10 (80:10:10) .87g .87
11 (85:10:5) .81 .41
14 80:15:5 1.13 .375
12 VYNS - BKO (83:17) 6.9 g VYNS 1.42 g BKO
13 (80:24) 1.73 g BKO
15 Gen 216-DOP-BKO (80:5:15) 6.g Gen 216 .375 g DOP 1.13g BKO
16 (84:8:8) .57g DOP .57g BKO
17 Gen 216 - BKO (80:20) 6g Gen 216 1.5 g BKO
18 (77:23) 1.8 g BKO

Cast on glass plate, dried in 65° C oven over nite
#6 & 7 are sticky - emulsion, 4,5,6,7 are somewhat opalescent & whitish.

Prep of 25% Solution of Gen 216
1000 g Gen 216
3000 g MEK.

Carl A Dahlquist
4-4-46

Carl A Dahlquist
4/4/46

hesiveness to remain tightly and snugly wrapped around splices and wires."

EXCERPTS FROM AFFIDAVIT OF WILLIAM E. LUNDQUIST, DATED MAY 8, 1953, ACCOMPANYING AMENDMENT OF MAY 12, 1953.

[P. 68, lines 5-14:]

"Said Exhibit D tape has imprinted on the core: 'SCOTCH' Brand Electrical Tape No. 33; and on the side of the core has imprinted: 2VBA 1 1D9L 5 C2. The backing of the tape marked Exhibit D was plasticized by the use of 32 parts of Paraplex G-40 (a high molecular weight polyester type plasticizer) and 16 parts of dioctyl phthalate (a substantially non-volatile liquid plasticizer) per 100 parts of a copolymer of 95% vinyl chloride and 5% of vinyl acetate."

[P. 75, 1st complete par.:]

"In accordance with the teaching of Oace et al (for example, see the Oace et al specification, page 5, line 23 et seq.) instead of using 2 parts of 'Paraplex G-25' (high molecular weight plasticizer) to 1 part of dioctyl phthalate (liquid plasticizer), where the 'Paraplex G-25' is replaced by a somewhat lower molecular weight plasticizer, the amount of liquid plasticizer may be correspondingly reduced or modified, with equivalent results. For example, where, instead of 'Paraplex G-25,' 'Paraplex G-53' or 'Paraplex G-50' are used to plasticize the vinyl polymer (Vinylite VYNW), the dioctyl phthalate or equivalent may be reduced or eliminated, with equivalent results. Tape has been made under affiant's directions, using 'Paraplex G-50' in one instance and 'Paraplex G-53' in another instance, and affiant demonstrated, to his own satisfaction, that the proportion of the dioctyl phthalate or equivalent may be modified suggested by Oace et al, and can be reduced to zero in such event, with equivalent results."

EXCERPTS FROM PATENT OFFICE ACTION, MAY 29, 1953.

[P. 95, pars. 2 and 3:]

"2. The denial for a reissue of patent No. 2,559,990 on the ground of estoppel is repeated.

"3. Claims 4 and 16, covering the polyvinyl chloride base film coated with a primer coating, and a superposed pressure-sensitive adhesive are allowable, provided that the Board of Appeals finds that applicants are entitled to the reissue of the patent."

EXCERPT FROM AMENDMENT OF JUNE 24, 1953.

[P. 98, lines 12-20:]

"In Office action dated May 29, 1953, the Examiner stated that claims 4 and 16 are allowable, provided the Board of Appeals finds that applicants are entitled to the reissue of the patent, i.e., provided the Board of Appeals reverses the Examiner's rejection on the ground of estoppel. Arguments in that regard are presented hereinafter.

"In view of the approved wording of claim 16, applicants have written three new claims, namely, claims 17, 18 and 19, designed to replace claims 10, 6 and 8, respectively."

Excerpts from Defendants' Exhibit 7, being a Report Dated December 20, 1944, of Esther Eastwold and W. E. Lundquist, Entitled "Elastic Solid Plasticizers—Tape Backings of Plasticized Vinyl Polymer Films," for Period from February 1, 1944, to September 20, 1944.

[P. 1:]

"In the past attempts have been made to prepare tape using plasticized vinyl chloride polymer films as backings.

These tapes failed because of migration of plasticizer from the backing to the adhesive, thereby making the adhesive too soft and stringy to be useful. Attempts have been made by the Tape Department to overcome this trouble by developing an adhesive which would be unaffected by the plasticizer in the backing, but this is a difficult problem and has not led to any usable construction.

"Under this project a study of plasticized vinyl chloride polymer films as tape backings has been undertaken to determine their effect on standard pressure-sensitive adhesives. It has been thought that if a plasticizer of high enough molecular weight were used, it would have no tendency to migrate and therefore would have no effect on ordinary pressure sensitive adhesives. About this time this work was started, Resinous Products and Chemicals Company brought out their Paraplex-G-25, which is a high molecular weight plasticizer for vinyl chloride polymers. Under the present study this resin was tested to determine what might be expected of a high molecular weight plasticizer as compared to the standard low molecular weight variety."

[P. 4:]

"Dioctyl phthalate was the most effective plasticizer tested, that is, it seemed to exert the greatest solvent power for the vinyl chloride polymers and gave the most pliable films. Paraplex G-25 had the poorest solvent and plasticizing action of the materials tested."

Excerpts from Defendants' Exhibit 8, Entitled "Elastic Solid Plasticizers—Stretchable Tape Backings," being Report Prepared by Esther Eastwold and Dr. W. L. Lundquist, Dated July 7, 1945, and being Report for the Period from September 20, 1944 to June 30, 1945.

[P. 2:]

"Vinylite VYNS-Chemigum N-1 films having high strength and stretch have been prepared. The use of about 25% of Chemigum gives strong films which elongate 50-100% before breaking whereas 40% gives strong films which elongate 400%. Vinylite VYNS films plasticized with dioctyl phthalate and Paraplex G-25 have continued to cause tack loss in standard adhesives coated on them."

[P. 5:]

"The VYNS-Paraplex G-25-dioctyl phthalate films caused loss of tack with all the adhesives tested and are probably not usable with these standard adhesives."

[P. 6:]

"Two low molecular weight vinyl chlorides copolymers (VYLS and VYHH) were evaluated. Both were too weak and brittle to be of interest.

Excerpt from Defendants' Exhibit 9, Report Prepared by Esther Eastwold [Mrs. LePage] for Period August 15 to February 8, 1946, and Dated February 8, 1946.

[P. 3:]

Patent Situation

A patent application, Ser. No. 641000, Oace, Snell, & Eastwold, was filed January 12 covering Paraplex G25-Flexol DOP plasticizer vinyl chloride-vinyl acetate copol-

ymer in which not more than about 20 parts DOP per 100 parts vinyl polymer and additional non-migrating high molecular weight plasticizer, such as G25, imparting additional elasticity are used. This combination obviates the shortcomings of either when used alone; viz., loss of tack with G25 and pastiness with DOP.

Excerpts from Defendants' Exhibit 12, "Semi-Monthly Report" of Esther Eastwold (Mrs. LePage).

[P. 38:]

"Period Ending
April 15, 1946

TO: DR. H. N. STEPHENS
Research Department
Colloid Section

"Semi-Monthly Report

. . . . . .

AR 42 — Elastic Solid Plasticizers — Esther Eastwold

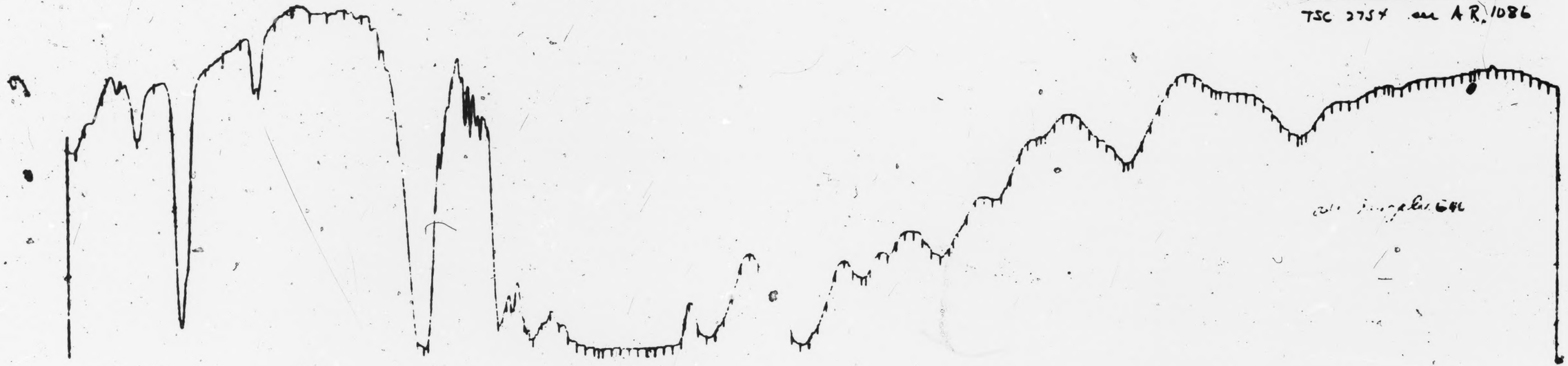
"The study of Paraplex G-40 as a plasticizer for Geon 200x5 and Vinylite VYNS has been completed, both with regard to elasticity data and to the behavior of adhesives coated on the plasticizer films. G-40 has been found equivalent to G-25. G-40 was tried as the only plasticizer and also evaluated in combination with D.O.P. Rubber adhesive A 73-5 and GR-S adhesive A 341 were considered to behave satisfactorily although there was some tack loss noted. In one formulation G-40 caused less tack loss than had been observed for G-25 in a previous evaluation. This may have been due to a lower caliper backing."

(A149)

Deft. L En 58-C ud
6/9/55 Ufs

6980. S-1957 SP
Plasticizer, Plymouth
Elect. Tape
Landolum
AMP
10270
Nat

TSC 2754 on A R 1086



Defs Exh 58 F-2

(A151)

FORM 58 5-28-50

COPIES FOR
HOGGINS
ARMSTRONG
AUBIN
GORDON
GRAHLFELL
CALABRESE
CHRISTENSEN
CORBIN
SNOW
VOEL
FORSE
GUSTAFSON
HOA
JOSEPHS
KOLLSTEDT
LINNEBOOTH
MEAD
LUNDQUIST
MC CUBBIN
MURRAY
PERLICH
RIVARD
TAPE LIBRARY
TIERNEY
WETZEL
WICKLUND

ANALYTICAL TEST REPORT

TAPE DEPARTMENT

AP-1086

May 28, 1951

SUBJECT: Competitive Plastic Electrical Tapes.

BACKGROUND: Quantitative and qualitative analysis of the plasticizers being used by competitors in the plastic electrical tape field has been requested relative to the claims which the patent office has allowed 3M.

ANALYSIS: Extractions of 1-2 gram samples of backing, free from adhesive, were performed in Soxhlet extractors using methanol solvent. The composition of each extract was ascertained by comparative infrared absorption spectra run by Central Analytical Research over the 2 to 15 micron wavelength region

RESULTS:

Tape	% Plasticizer	Type Plasticizer
[redacted] (TSC-2806)	23.9	Polyester & phosphate
[redacted] (TSC-2809)	26.?	Polyester
[redacted] (TSC-2785)	27.9	Polyester
[redacted] (TSC-2653)	30.6	Polyester
Van Cleef Bros. Inc.		
Dutch Brand "Plastix" (TSC-2758)	35.1	Polyester
Dutch Brand "Plastix" (TSC-2720)	36.2	Polyester
Superior Insulating Tape Co.		
No. 6 Plastic Electrical	34.9	Polyester
[redacted] Tape (TSC-2828)	35.0	Polyester
[redacted] Tape (TSC-2820)	21.3	Polyester
Plymouth Rubber Co		
Plymouth Plastic Electrical Tape (TSC-2754)	24.9	Polyester
3M Co. - Control Samples		
#33 Electrical VBA (11B3N-5B4)	21.6	Polyester & phthalate
#33 Electrical 2VBA	27.9	" "
Uncoated Backing used in 2VBA above	28.0	" "
#33 Electrical VPH	23.9	" "

DISCUSSION: The increasing use of polyester type plasticizer indicates that the light, linear polyesters can give satisfactory low temperature performance while still maintaining

resistance to migration. These apparently are the salient factors in the displacement of the monomeric phthalate and phosphate plasticizers.

REFERENCE: Notebook 2141, page 1-2

R. W. Lundbohm

rwl/jh

cc-E. Bond
W. McKee (2)
L. Swanson

[redacted] 8-28-50
58-7

COPIES FOR
HERRING
ARMSTRONG
AUSER
GORDON
DOUGLAS
GALAGHER
CHRISTENSEN
COGGIN
SNOW
EGAN
FORDE
GUSTAFSON
O'NEAL
JOESTING
HELLGREN
LINNEBOOTH
LUCAS
LUNDGREN CE
LUNDQUIST
MC CUDDIN
MURRAY
PERLICH
RIVARD
TAPE LIBRARY
THORNEY
WETTER
WICKLUND

(AIJS) Deft's Ex 58-Fid 6/9/55 HPB

ANALYTICAL TEST REPORT

TAPE DEPARTMENT

AP-1086

May 28, 1951

SUBJECT: Competitive Plastic Electrical Tapes.

BACKGROUND: Quantitative and qualitative analysis of the plasticizers being used by competitors in the plastic electrica tape field has been requested relative to the claims which the patent office has allowed 3M.

ANALYSES: Extractions of 1-2 gram samples of backing, free from adhesive, were performed in Soxhlet extractors using methanol solvent. The composition of each extract was ascertained by comparative infrared absorption spectra run by Central Analytical Research over the 2 to 15 micron wavelength region.

RESULTS:

Tape	% Plasticizer	Type Plasticizer
[redacted] (TSC-2806)	23.9	Polyester & phosphate
[redacted] (TSC-2809)	26.2	Polyester
[redacted] (TSC-2785)	27.9	Polyester
[redacted] (TSC-2653)	30.6	Polyester
Van Cleef Bros. Inc.		
Dutch Brand "Plastix" (TSC-2758)	35.1	Polyester
Dutch Brand "Plastix" (TSC-2720)	36.2	Polyester
Superior Insulating Tape Co.		
No.60 Plastic Electrical	34.9	Polyester
[redacted] Tape (TSC-2828)	35.0	Polyester
[redacted] Tape (TSC-2820)	21.3	Polyester
Plymouth Rubber Co		
Plymouth Plastic Electrical Tape (TSC-2754)	24.9	Polyester
3M Co. - Control Samples		
#33 Electrical VBA (TSC-2754)	21.6	Polyester & phthalate
#33 Electrical 2VBA	27.9	" "
Uncoated Backing used in 2VBA above	28.3	" "
#33 Electrical VFH	21.9	" "

[redacted]

(A.E.I. v. Plaintiff)

Page 3 of Defendants' Exhibit 52, Booklet of Resinous Products & Chemical Co., "Paraplex G-25 and G-40," March 1947.

PARAPLEX

G-25 and G-40

Introduction

PARAPLEX G-25 and G-40 are resinous polyesters, permanently soft and thermoplastic in nature, and very stable. They are outstanding plasticizers for polyvinyl chloride, the vinyl copolymer resins, and elastomers of the acrylonitrile-butadiene type in applications where the ultimate in permanence is required in the finished compound.

A satisfactory plasticizer for use with polyvinyl chloride copolymers must show the basic requirements of good compatibility and efficiency, as well as satisfactory water resistance and permanence. Outstanding plasticizers, in addition, will produce a compound showing such special properities as low-temperature flexibility, oil-resistance, low flammability and heat stability. Paraplex G-25 and G-40 are unique in their ability to impart these desirable qualities to vinyl compounds. They are outstanding plasticizers for those uses where freedom from lacquer lifting is a prerequisite. They are especially valuable, therefore, in free films for handbags, luggage and similar applications.

These polyesters combine many of the desirable features of the ester-type plasticizers with the permanence and added resistance to extraction that are obtainable only in a synthetic resin plasticizer. Compounds in which Paraplex G-25 and G-40 serve as the principal plasticizer exhibit the following properties:

Resistance to oils and gasoline
Essentially zero volatility
Excellent heat stability
No plasticizer migration
Low flammability
Good low-temperature flexibility
Excellent stability on exposure to ultraviolet, particularly in the case of Paraplex G-25
Very low heat-deformation
Very good water resistance
Excellent processing properties

In this booklet has been summarized the information accumulated during extensive laboratory and field evaluation of Paraplex G-25 and G-40 since the introduction of these resinous polyesters several years ago. Additional data on specific applications will be supplied gladly upon request.

Page 6 of Defendants' Exhibit 52, Booklet of Resinous Products & Chemical Co., "Paraplex G-25 and G-40," March 1947.

COMPATIBILITY CHARACTERISTICS

Paraplex G-40 is not compatible with as wide a variety of materials as is Paraplex G-25. The compatibility characteristics of Paraplex G-40 are given in the following table.

COMPATIBLE

Polyvinyl Chloride (up to 35% G-40)
Vinyl copolymer resins (up to 40% G-40)
Buna N-type synthetic rubbers
Neoprene

INCOMPATIBLE

Cellulose Acetate (PM-3)
Cellulose Acetate (FM-6)
Polyvinyl Butyral (VF-7100)
Polyvinyl Butyral (VF-7200)
Polystyrene
Polymethyl methacrylate
Cumar P-10
Cumar P-25
Uformite F-200E
Amberol ST-137

Like Paraplex G-25, Paraplex G-40 may be handled successfully by allowing the material to stand overnight in a warm room before use. Exposure to temperatures of 88° C. for several weeks in glass containers produces little change in the color, acid number, and viscosity of Paraplex G-40. The volatility loss at temperatures up to 150° C. over a 16-hour period is negligible.

Cooling Paraplex G-40 to −79° C. in a dry ice-methanol bath causes no crystallization. Similarly, exposure for 3 days at −30° C. does not cause freezing. The material becomes hard but remains amorphous.

The wide range of conditions over which Paraplex G-40 retains its physical properties is an indication of the stability which may be expected in stocks containing this plasticizer.

When Paraplex G-40 is used with vinyl elastomers at concentrations approaching the upper limits of compatibility listed above, exposure of the material to high humidity may result in surface exudation. This must be kept in mind where Paraplex G-40 is the sole plasticizer. However, since it is common practice to use Paraplex G-40 in conjunction with a monomeric material, this problem does not arise frequently.

SECTION II—USE OF PARAPLEX G-25 AND G-40 WITH POLYVINYL CHLORIDE AND COPOLYMERS

Paraplex G-25 and G-40 have been used successfully with all of the commercially available polyvinyl chloride and vinyl copolymer resins.

MILLING TECHNIQUE

The technique used in compounding Paraplex G-25 and G-40 with the vinyl resins is similar, in general, to that customarily employed with liquid plasticizers of the ester type. The principal difference is that the resinous plasticizers, since they are high molecular weight compounds, do not exert the solvating effect of monomerics. They are as compatible as the monomeric plasticizers in the final product, but it requires more vigorous treatment to bring the vinyl polymer and resin plasticizer together.

Large-scale processors who use Banbury equipment, followed by mill refining before calendering, will find that only a slightly longer time and a higher temperature in the Banbury are required with the Paraplex resins.

On the other hand, where milling alone is involved, the longer time necessary for incorporation of Paraplex resins and the higher temperatures necessary to effect fluxing become quite apparent. When stocks containing resinous plasticizers are milled, it is advisable to blend the Paraplex in advance, using suitable heavy-duty equipment. After it has been fused and banded, the batch should be milled for a short time to insure complete homogeneity. The use of monomeric plasticizers with the Paraplex resins to facilitate milling is a common practice. The following mill roll temperatures are suggested for milling the Paraplex plasticizers with various vinyl resins.

Geon 101	310° to 320° F.
Geon 102	230° to 240° F.
Geon 202	230° to 240° F.
Vinylite VYNW	290° to 300° F.
Vinylite VYNS	230° to 240° F.

Page 5 of Defendants' Exhibit 23, Booklet entitled "Paraplex G-25," June 1944

THE RESINOUS PRODUCTS & CHEMICAL CO.

TABLE I — COMPARISON OF PARAPLEX G-25 WITH ESTER TYPE PLASTICIZERS IN VYNW

Plasticizer	Paraplex G-25	Dioctyl Phthalate	Tricresyl Phosphate	Dibutyl Sebacate
Tensile	2700	2650	3300	2100
Modulus at 100%	1648	1062	1438	540
Bend-Brittle Point ° C.[1]	−50	−50	−40	below −74
Volatility Loss %[2]	less than 0.1	less than 0.1	less than 0.1	9.8
Heat Stability[3]	6	3.5	3	5
Heat Deformation %[8]	11.0%	13.6%	18.0%	21.4%
Flammability[4]				
% Burned	4	100	0	100
Burning time (secs.)	4.1	19.1	2.4	17
Extraction Loss %[5]				
Water	less than 0.1	less than 0.1	less than 0.1	0.3
Nujol	less than 0.1	8.4	1.8	24.6
100 Octane Gas	2.4	—	22.6	—
Aromatic Fuel[6]	19.0	—	28.7	—

[1]Test specimens ½ inch x 6 inches x .080 inch stored 24 hrs. at −30° C. Specimens transferred quickly from cold box to methanol-dry ice bath with 5 minutes immersion for temperature equalization; then bent through 180° over ⅜ inch rod. Temperature of methanol bath lowered in 5° C. increments until specimen broke. The values above are those temperatures at which samples cracked.

[2]Volatility determined in circulating air oven. Stocks exposed 10 days at 60° C. Results reported as percent loss in original weight.

[3]Hours at 150° C. before appreciable discoloration or other change.

[4]Standard ASTM test (DTYI-41T) using .010 inch film and N/C fuse.

[5]Values expressed as percent loss in weight of original .010 inch film after 10 days' immersion at room temperature. Water changed 10 times, Nujol once, gasoline and aromatic fuel not changed during tests.

[6]AMS-3212 Fuel—contains 60 percent 100 octane gasoline, 20 percent toluol, 15 percent xylol, 5 percent benzol.

[7]Extraction loss of DOP and DBS in 100 octane gasoline and aromatic fuel not shown. It is well known that both of these plasticizers are almost completely extracted by such solvents.

[8]Improvised test which gives comparative values only. Stock subjected to load of 50 pounds per square inch for 1 hour at 120° C.

A161

Deft.'s Ex 24 id 2/16/55 MJS

Nov. 44

Title Page of Defendants' Ex. 24

PLASTICIZERS FOR USE WITH POLYVINYL CHLORIDE AND COPOLYMERS

THE RESINOUS PRODUCTS & CHEMICAL COMPANY
WASHINGTON SQUARE PHILADELPHIA 5, PA.

Page 2 of Defendants' Exhibit 24

Introduction

To be satisfactory for use with polyvinyl chloride or copolymers, any plasticizer must show the basic requirements of good compatibility and efficiency, as well as satisfactory water resistance and permanence. The outstanding plasticizers, in addition, will produce a compound showing such special properties as low temperature flexibility, oil resistance, non-flammability or low cost.

We feel that our various plasticizers may be classified in this second group and in each case, offer a unique combination of properties. As examples, we cite Dibutyl Sebacate for low temperature flexibility, Paraplex G-25 for oil resistance and non-migratory properties, and Plasticizer 35 for extremely low cost applications.

As a rule, the monomeric or elasticator types, when incorporated with polyvinyl chloride, are characterized by good plasticizing efficiency, good low temperature flexibility and poor resistance to plasticizer migration and extraction. In contrast, the polymeric or resinous types will show only fair plasticizing efficiency but excellent heat stability, permanence and unsurpassed resistance to migration and extraction. Most resins are incompatible with polyvinyl chloride and to our knowledge, Paraplex G-25 is the only one which is being used commercially.

For guidance the plasticizers are discussed as follows:

I. Monomeric or Elasticator Types

- A. Esters
  1. Dibutyl Sebacate
  2. Dibenzyl Sebacate
  3. Dioctyl Sebacate
  4. Dicapryl Phthalate
- B. Amides
  1. Plasticizer 35
  2. Plasticizer 36

II. Polymeric or Resinous Types

1. Paraplex G-25

The appendix follows the discussion of the individual plasticizers and discusses compounding and testing procedure in detail.

It will be noted that the formulations discussed herein, in most cases, involve the use of only one plasticizer. This does not mean to imply that binary or ternary systems are not to be considered. Commercial practice has proven that, in many systems, the use of a "compatibilizing" plasticizer will make possible the use of one showing desirable properties, or reduced cost, which otherwise could not be used. The use of Plasticizer 35 with Dicapryl Phthalate is a case in point. A complete study of such binary or ternary systems, however, is not within the scope of this booklet but we plan to have more complete data thereon in the future.

PATENTS

July 17, 1934	1,966,856
Oct. 31, 1939	2,177,627
June 1, 1943	2,320,442
Oct. 19, 1943	2,332,265
Oct. 29, 1946	2,410,089
Sept. 13, 1949	2,481,896
June 29, 1954	Re. 23,843

Patented July 17, 1934 1,966,856

UNITED STATES PATENT OFFICE

1,966,856

PLASTIC COMPOSITION

Frazier Groff, Charleston, W. Va., assignor to Carbide & Carbon Chemicals Corporation, a corporation of New York

No Drawing. Application August 10, 1931, Serial No. 556,300

10 Claims. (Cl. 106—22)

The invention relates to plastic compositions containing vinyl resins, that is, resins formed by the polymerization of certain vinyl compounds.

Vinyl resins of various types are known and various uses have been proposed for these substances. Previously prepared plastic compositions containing vinyl resins have not been uniformly satisfactory. It has been proposed to make improved vinyl resins by polymerizing a mixture of vinyl compounds, and by including other substances in the resins. These proposals have resulted in generally improved vinyl resins, but vinyl resins possessing the requisite uniformity of properties to make plastic compositions prepared from them economically successful have not been heretofore known.

The principal object of my invention is to provide a novel type of vinyl resins possessing uniformly desirable properties for the preparation of plastic compositions. Another object is to provide a novel molding composition containing vinyl resins, which is especially useful for forming phonograph or other sound records. Another object is to provide a novel plastic composition suitable for use as a wall or floor surfacing material, and still another object is to provide a novel moisture-proof packaging and insulating material.

The vinyl resins employed in my new plastic compositions are those which are obtained by the conjoint polymerization (by which is meant polymerization while in mutual contact) of a vinyl halide and a vinylester of an aliphatic acid. I prefer to use vinyl resins formed by the conjoint polymerization of vinyl chloride and vinyl acetate in the presence of a polymerizing catalyst. The preferred proportions by weight of vinyl chloride to vinyl acetate are 70% or more of vinyl chloride and 30% or less of vinyl acetate. Throughout the specification and the claims all the new compositions will be described on a percentage or parts by weight basis.

I have found by test that the vinyl resins above described are best suited to the formation of the plastic compositions of the present invention. However, not every vinyl resin formed by the conjoint polymerization of 70% or more of vinyl chloride and 30% or less of vinyl acetate is suitable for use in the new plastic compositions. The resins must further possess a high fusion point, low solubility, and must be tough, stable and resistant to heat. In order to make my novel plastics economically practical, the resins contained therein must be of uniform quality with respect to the properties set forth. A uniform vinyl resin of this type may be characterized by indicating the extent to which it is soluble in certain solvents, since this property is an accurate indication of the other properties of the resin. I therefore designate the vinyl resin which is preferred as an ingredient of my plastic compositions, as a resin resulting from the conjoint polymerization of vinyl chloride and vinyl acetate in the proportions of 70% or more of vinyl chloride and 30% or less of vinyl acetate, less than about 30% of the resin being soluble in cold (20° to 30° C.) toluene.

The preferred type of resins may be produced by causing a mixture of the vinyl compounds in the proportions thereof as set forth above to be polymerized in the presence of a suitable liquid medium, such as aliphatic paraffin hydrocarbons, aliphatic alcohols, and aliphatic ketones, and in the presence of a suitable polymerizing catalyst, such as benzoyl peroxide, at temperatures below about 60° C. The process of forming such vinyl resins does not form an essential part of the present invention.

In order to insure complete stability of the vinyl resin it is generally desirable to add to the resin a stabilizing substance or susbtances. In general, suitable stabilizing agents are basic in property and do not promote acid formation or oxidation. Examples of suitable stabilizers are: alkaline earth metal soaps, resinates, oxides, hydrates and carbonates; aromatic amino compounds which are water insoluble; other amines or ammonia and its substitution products generally. Specifically, calcium stearate, lime, the reaction product of calcium hydrate and manilla copal resin, ethyl toluidine, benzidine, tribenzyl amine, and the ethanolamines are preferred stabilizers. I have discovered that the preparation of light colored vinyl resin plastics is facilitated, and that the colors are more stable toward light, if titanium oxide or calcium carbonate, or both are included in the plastic composition.

The vinyl resin plastics may be readily prepared in permanent colors of any shade by the addition of dyes, lakes or pigments.

The above described vinyl resins which may be stabilized and colored as desired are the basic ingredients of my new plastics. Certain plastic compositions require the inclusion of filling materials. I have found that cellulosic or non-cellulosic fillers in various proportions may be used with the vinyl resins. Examples of cellulosic fillers are wood flour, cork, cotton flock, cotton linters and paper pulp; examples of non-

cellulosic fillers are barytes, silica, mica, asbestos, talc and rottenstone.

The plasticity of the plastic compositions may be altered and their flexibility and resilience may be varied by the addition of various plasticizers or modifying agents to the compositions. Typical plasticizers and modifiers are phthalic acid esters, halogenated napthalene derivatives, carnauba wax, certain rubber fractions, chlorinated diphenyl derivatives, tricresyl derivatives and glycol esters.

I am enabled to produce a wide variety of new plastic compositions by means of the above additions to the vinyl resins. The nature and properties of the plastic products are governed by the choice of ingredients and amounts thereof which are incorporated with the vinyl resin.

In general, plastic compositions which are adapted to the formation of molded objects by the application of thermo-plastic molding operations are prepared by incorporating from about 25 to 70 parts of a filling material and 1 to 5 parts of a plasticizer with from about 75 to 30 parts of the preferred vinyl resin, which may be colored and stabilized as desired. The molding compositions may be varied by using larger amounts of plasticizing materials, and molding lubricants may be used optionally. In some instances the unfilled resin may be used to form molded objects. For example, the unfilled resin, with or without plasticizers or modifying agents, and colored as desired, may be used to form dentures and the like.

Another type of plastic composition has as its basic ingredient a vinyl resin of the preferred type in conjunction with a large proportion of a plasticizing material. This composition may be formed into thin sheets and is useful as a moisture-proof, insulating packaging material. It may vary in thickness from 0.0004 inch to 0.250 inch and may be colored, opaque, transparent or translucent as desired. The sheets are very flexible and if suitable plasticizers are chosen, the plastics are resilient and flexible over a wide temperature range, including very low temperatures, i.e.—10° C. or lower. This material is useful not only as a protective or ornamental packaging material but as an electrical insulating material for use in cable, condenser and switchboard insulation.

If it is intended as a packaging material its attractiveness may be enhanced by including various odoriferous substances in the composition to produce a perfumed wrapping material. It may be easily cemented to form seals and joints by softening the sheet with a solvent for the composition and then applying pressure.

The plasticized flexible material may be incorporated with a filler, such as cork dust or asbestos, and secured to a fibrous backing, for example, burlap, to form a linoleum-like product suitable for covering floors and walls. This product may be formed either by hot pressing the plastic against the backing or by securing a preformed sheet of the plastic to the backing with an adhesive, such as a solution of a vinyl resin in acetone. The resultant product may be cut, bent, nailed and treated in the usual way as a floor-covering material, and possesses good wearing qualities. The plastic and filler may be mixed into a paste with a medium-boiling solvent and used as a troweling composition to fill joints in the floor or wall covering material. In this case the plastic is hardened by the evaporation of the solvent.

The compositions of my invention are substantially non-flammable as evidenced by the fact that a vinyl resin composition containing 50% of wood flour will not support combustion. Also, they are odorless, resistant to water, chemically inert and dielectric.

The following examples are illustrative of the invention:

I. A molding composition was prepared as follows:

50 parts of vinyl resin
30 parts of ground barytes
20 parts of rottenstone
0.5 parts of carnauba wax
0.5 parts of calcium stearate
0.5 parts of lime

The vinyl resin was prepared by polymerizing a mixture containing 80% of vinyl chloride and 20% of vinyl acetate in the presence of benzoyl peroxide, and was less than 25% soluble in cold toluene. The materials were mixed and milled to form a substantially homogeneous composition.

The composition is suitable for molding various articles, particularly phonograph records, both of the rigid and flexible type. The composition may be used to form phonograph records directly, or they may be formed by molding the composition over a flexible cellulosic or similar sheet. By the use of this composition it is possible to make flexible records having either one or two playing surfaces. The formation of these flexible records is facilitated because the use of solvents in applying the vinyl resin playing surface or surfaces is unnecessary, the coating being applied by a hot pressing operation. Rigid records formed from vinyl resin compositions may be produced in thicknesses down to about 0.025 inch and are characterized by unusual toughness and mechanical strength.

In every case the records produced possess a high degree of water resistance and resistance to atmospheric conditions. Also, the records are extremely resistant to needle wear and exhibit but slight wear on the needle. This latter property is shown by the fact that a single needle may be used to play a record formed from a vinyl resin composition 200 times before becoming worn sufficiently to require replacement, while by comparison, the same type of needle can be used to play records of the kind now commercially available but once before being worn to the same degree. The records formed from vinyl resins are also characterized by an extremely low surface noise level. This characteristic, together with the mechanical strength of the resin and the accuracy with which it may be molded, makes it possible to form records having more recorded sound per square inch of playing surface than is possible with records formed from other materials.

II. Another molding composition for general use, and for sound records, was prepared as follows:

500 parts of vinyl resin
5 parts of calcium stearate and lime
5 parts of carnauba wax
40 parts of fibrous talc
435 parts of cotton flock
25 parts of coloring materials

The vinyl resin of this composition was pre-

pared as described in Example I, and was about 88% insoluble in cold toluene.

III. A simple molding composition may be as follows:

200 parts of vinyl resin
200 parts of wood flour
8 parts of carbon black

The vinyl resin used in this composition was identical with that of Example I and was previously stabilized. The molding composition of this example is useful for forming molded objects of low cost. It produces objects which are hard but not brittle.

The molding operations by which these compositions may be utilized are the usual thermoplastic operations employing heat and pressure. For example, bars consisting of 31 grams of the composition of Example III were molded under 1900 pounds per square inch of pressure at 130° C. for 8 minutes. They were then cooled under a pressure of about 400 pounds per square inch. The molding conditions are dependent upon the molding composition, the object molded and upon each other, and are subject to wide variations. In general pressures from 200 to 2000 pounds per square inch may be used and temperatures of about 130° to 140° C. are preferred.

IV. A highly plastic composition was formed as follows:

100 parts of vinyl resin
60 parts of ethylene glycol monoethyl ether diester of ethylene glycol diphthalate
1 part of carnauba wax
1 part of calcium stearate
1 part of calcium hydrate

The vinyl resin was a product formed by the conjoint polymerization of 80 parts of vinyl chloride and 20 parts of vinyl acetate and was less than 30% soluble in cold toluene. The ingredients of this composition were mixed by fluxing on hot (100° to 120° C.) differential rolls, and the mix was sheeted out. This composition is well adapted as an ingredient of varnishes or lacquers and may be mixed with filling materials to form molded articles possessing a high degree of resilience and flexibility. Sheets of this composition retained their flexibility and discolored but slightly after 100 hours of exposure to the radiation from a mercury arc lamp at a distance of 20 inches from the bulb.

V. The composition of this example was composed of the following:

100 parts of vinyl resin
10 parts of diethylene glycol monophthalate previously neutralized with orthotoluidine

The resin used in this composition was the same as that of Example IV. The mixture was fluxed on differential rolls heated to 80° to 120° C. until a uniform mix was secured. This may be lubricated with carnauba wax and molded to form tough, flexible phonograph records having the desirable properties above described. If it is desired, filling materials, such as wood flour or barytes, may be added to this composition, and sheets of the filled material may be molded over paper to form flexible phonograph records. This type of record is especially adapted for use in forming reproducing records for home recording.

VI. A tough, plasticized composition was produced as follows:

100 parts of vinyl resin
10 parts of ethylene glycol monomethyl ether phthalate neutralized with tribenzylamine
1 part of carnauba wax
0.5 part of calcium stearate
0.5 part of calcium hydrate
100 parts of cotton flock

The vinyl resin was identical with the resin described in Example IV. The ingredients of this composition were mixed and then rolled on differential rolls heated to about 110° to 130° C. This composition is well adapted for surfacing soft cores, metal sheets, and the like by molding operations. The toughness of this composition is demonstrated by the fact that a nail was driven through the center of a disc 2 inches in diameter and ¼ inch in thickness molded from this composition without splitting or cracking the disc.

VII. An example of a floor covering material is as follows:

100 parts of vinyl resin
40 parts of ethylene glycol monoethyl ether diester of ethylene glycol diphthalate
140 parts of ground cork
70 parts of barytes

The vinyl resin was formed by conjointly polymerizing 80 parts of vinyl chloride and 20 parts of vinyl acetate, and was 85% insoluble in toluene at 25° C. The ingredients were thoroughly mixed by fluxing on heated differential rolls and formed into sheets. These sheets were then molded over burlap to form a linoleum-like product which possessed excellent wearing qualities.

VIII. Another floor covering material was prepared as follows:

310 parts of a 40% solution of vinyl resin in ethyl acetate
60 parts of ethylene glycol monoethyl ether diester of ethylene glycol diphthalate
3 parts of ortho-toluidine
100 parts of acetone
230 parts of approximately 6 to 8 mesh ground cork
2 parts of calcium stearate
3 parts of carnauba wax

These ingredients were thoroughly mixed and air-dried. The vinyl resin used was identical with the resin described in Example VII. The resulting mixture was a thick, viscous mass characterized by a crawling type of flow. A portion of this mix was distributed over burlap and the residual solvent was evaporated. This piece was then densified by a hot-pressing operation under a pressure of about 150 pounds per square inch. This material was very flexible and tough and resembled a flexible linoleum.

Another portion of this mix was dried to remove the solvent, distributed over a sheet of burlap and hot-pressed under a pressure of about 100 pounds per square inch. The product was very similar to that formed in the first operation.

IX. A troweling composition was formed by mixing

100 parts of vinyl resin plasticized with 30% of its weight of ethylene glycol monoethyl ether diester of ethylene glycol disphtalate
300 parts of acetone
150 parts of asbestos
20 parts of ground cork

When a uniform mixture had been obtained, it could be applied to any desired surface by a troweling operation. About 12 hours of air drying was sufficient to eliminate all the solvent and the resultant coating was tough, adhesive and resilient. It adhered well to wood, metal, burlap, paper, and the like. A smooth surface may be imparted to this coating by applying a surface coating of a vinyl resin solution. The resin used in forming this composition was identical with that used in Example VII.

X. A transparent flexible wrapping material was produced as follows:

100 parts of vinyl resin
20 parts of dibutyl phthalate
1.5 parts of carnauba wax
1 part of calcium stearate

The resin was produced by conjointly polymerizing 80 parts of vinyl chloride and 20 parts of vinyl acetate, and was about 75% insoluble in toluene at 25° C. These materials were fluxed on hot differential rolls and sheeted out in sheets of about 0.001 inch in thickness. These sheets are useful as a moisture-proof, non-flammable packaging material, or as an insulating material. The material is tough, flexible, resistant to heat and ultra-violet light, and possesses good tensile strength. It may be perfumed, colored, and produced in any thickness and degree of transparency.

XI. The process of forming the material of Example X may be modified by dissolving 240 parts of the composition of Example X in 400 parts of acetone and 200 parts of ethyl acetate. The solution is formed into sheets by pouring it onto a plate of polished metal, infusible phenolic resin plastic, or glass. The plasticized composition described has but slight tendency to adhere to the materials on which it is plated, and such tendency may be eliminated by lubricating the plate with a substance, such as carnauba wax. The sheets are suitable for use as wrapping or insulating materials, and may be formed into thicker or thinner sheets by pressing or calendaring the sheets which were originally formed.

From the foregoing description the method of practicing my invention and the uses of my new plastic compositions will be apparent. Modifications of the invention are possible and are included in my invention as defined by the appended claims.

I claim:—

1. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material, said vinyl resin being identical with that resulting from the conjoint polymerization of a vinyl halide and a vinyl ester of an aliphatic acid in the proportions of at least 70% of the vinyl halide and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

2. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material, said vinyl resin being identical with that resulting from the conjoint polymerization of vinyl chloride and vinyl acetate in the proportions of at least 70% of the vinyl chloride and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

3. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material, said vinyl resin being identical with that resulting from the conjoint polymerization of vinyl chloride and vinyl acetate in the proportions of about 80% of the vinyl chloride and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

4. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material and plasticizing material, said vinyl resin being identical with that resulting from the conjoint polymerization of a vinyl halide and a vinyl ester of an aliphatic acid in the proportions of at least 70% of the vinyl halide and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

5. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material and plasticizing material, said vinyl resin being identical with that resulting from the conjoint polymerization of vinyl chloride and vinyl acetate in the proportions of at least 70% of the vinyl chloride and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

6. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material and plasticizing material, said vinyl resin being identical with that resulting from the conjoint polymerization of vinyl chloride and vinyl acetate in the proportions of about 80% of the vinyl chloride and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

7. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material, and filling material, said vinyl resin being identical with that resulting from the conjoint polymerization of a vinyl halide and a vinyl ester of an aliphatic acid in the proportions of at least 70% of the vinyl halide and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

8. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material, plasticizing material and filling material, said vinyl resin being identical with that resulting from the conjoint polymerization of a vinyl halide and vinyl ester of an aliphatic acid in the proportions of at least 70% of the vinyl halide and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

9. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material and filling material, said vinyl resin being identical with that resulting from the conjoint polymerization of vinyl chloride and vinyl acetate in the proportions of about 80% of the vinyl chloride and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

10. A plastic composition comprising a substantial proportion of vinyl resin together with basic stabilizing material, plasticing material and filling material, said vinyl resin being identical with that resulting from the conjoint polymerization of vinyl chloride and vinyl acetate in the proportions of about 80% of the vinyl chloride and said vinyl resin being at least about 70% insoluble in toluene at 20° to 30° C.

FRAZIER GROFF.

Oct. 31, 1939. R. G. DREW 2,177,627

ADHESIVE SHEETING

Original Filed June 10, 1933

Fig. 1.

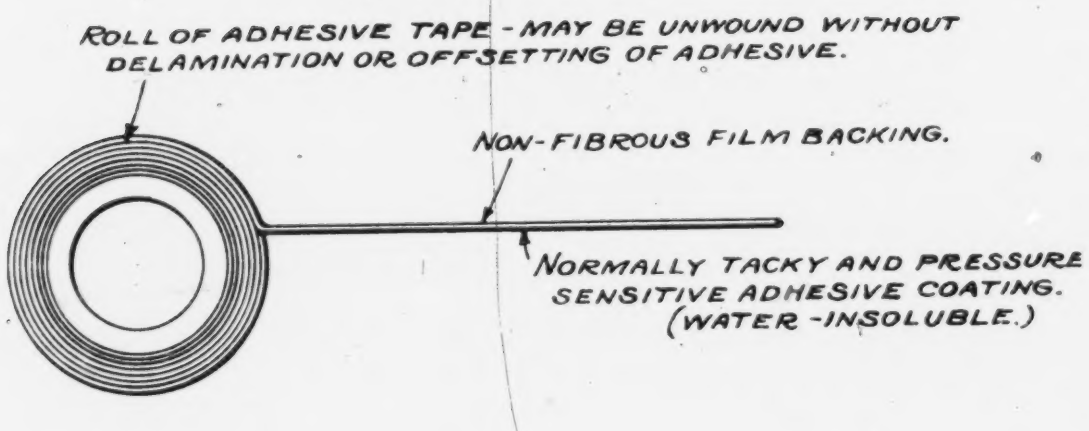


Fig. 2.

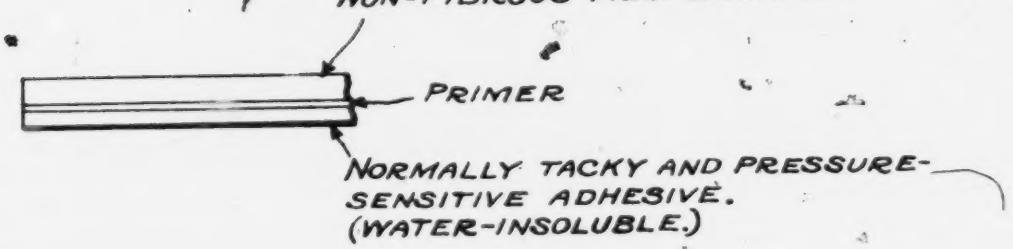
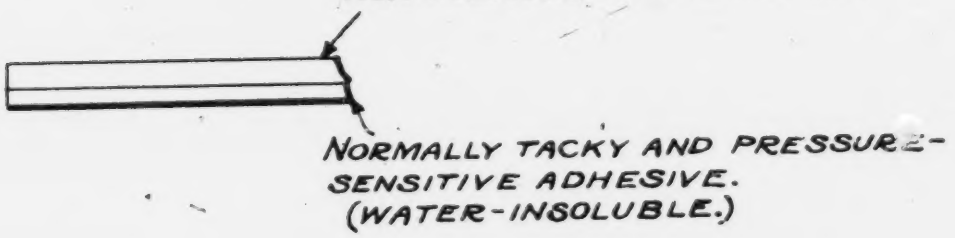


Fig. 3.



Inventor

Richard Gurley Drew.

By Paul Carpenter.

Attorney

Patented Oct. 31, 1939

2,177,627

UNITED STATES PATENT OFFICE

2,177,627

ADHESIVE SHEETING

Richard Gurley Drew, St. Paul, Minn., assignor to Minnesota Mining & Manufacturing Company, St. Paul, Minn., a corporation of Delaware

Original application June 10, 1933, Serial No. 675,291. Divided and this application February 18, 1938, Serial No. 191,259

16 Claims. (Cl. 91—68)

This invention relates to adhesive sheets having a backing with a non-fibrous surface (such as normal or waterproofed films of regenerated cellulose) and a coating of normally tacky and pressure-sensitive adhesive united thereto. While not limited thereto, the invention relates especially to transparent adhesive sheets, to adhesive sheets in the form of adhesive tapes which may be sold in stacked or coiled form, and to adhesive sheets or tapes which are well adapted to the sealing or securing of wrappers composed of non-fibrous lustrous cellulosic films and the like.

This application is a division of my co-pending application Ser. No. 675,291, filed June 10, 1933, and is in part a continuation of my co-pending application Ser. No. 534,386, filed May 1, 1931.

The development of packaging and wrapping sheets composed of thin, transparent and flexible non-fibrous films has raised special problems as to sealing or fastening with adhesives. Likewise, the desirability of using such films as backings for adhesive tapes cannot be met by use of the old conventional adhesives. Such sheet material is exemplified by gelatinized cellulosic materials which form films, such as regenerated cellulose, cellulose esters (as cellulose nitrate, cellulose acetate-butyrate and cellulose acetate), and cellulose ethers (as ethyl cellulose and benzyl cellulose), and by regenerated cellulose films which have been waterproofed by coating on one or both sides with a layer or film of a cellulose derivative. The popularity of these materials resides in such qualities as brilliancy, sheen and transparency, and in the later development of such material, in the quality of waterproofness. Ordinary glue type adhesives are insufficiently adherent by reason of the non-porous or highly glazed surfaces provided by this type of sheet material.

In accordance with this invention, sheets of such film material are provided with coatings of normally tacky and pressure-sensitive adhesive firmly united thereto. By "normally tacky and pressure-sensitive" it is meant that under ordinary atmospheric conditions the adhesive is stably in a condition such that it does not need to be activated by solvents or heat or otherwise prepared in order to secure good adherence to surfaces against which the adhesive coating (with its backing) may be pressed when used. An adhesive coating is provided which enables the adhesive sheeting to be affixed to smooth lustrous surfaces, such as non-fibrous cellulosic surfaces of wrapping or packaging sheets or films. An object of the invention is to provide a unified adhesive coating possessed of such coherence in relation to adhesiveness and so firmly united to its backing that the adhesive sheet may be stripped from smooth non-fibrous surfaces (not possessing special chemical affinity for the adhesive), to which it may have been temporarily applied, without offsetting of adhesive material. Hence the adhesive coating may be termed "non-offsetting", and this expression designates an important physical or physico-chemical property or characteristic of the adhesive coating, namely, that its coherency is greater than its adhesiveness. Further, an object is to provide adhesive sheets having an adhesive coating that is in elastic equilibrium with its backing so that warping and curling of the sheet, and blistering of the adhesive coating, are avoided.

In the accompanying drawing:

Fig. 1 shows a roll of adhesive tape, the tape having a non-fibrous film backing provided with a water-insoluble normally tacky and pressure-sensitive adhesive coating, which may be unwound without delamination or offsetting of adhesive;

Fig. 2 is a diagrammatic cross-sectional representation of a construction in which a primer coating is interposed between the backing film and the normally tacky and pressure-sensitive adhesive coating; and

Fig. 3 is a corresponding representation in which the primer coating is omitted.

Adhesive sheets are provided in which all components and the composite are transparent, so that the sheets may be applied without concealing the coloring or markings of the surfaces to which applied.

The transparent backing may be printed in reverse, on the face which carries the adhesive and prior to coating, to provide an adhesive sheet with the printing visible through and protected by the backing.

The adhesive sheets may be prepared with a surface continuously coated with adhesive, as in the case of ordinary adhesive tapes, labels and seals, or with the adhesive on certain areas only, as in the case of a packaging sheet provided with coated portions to permit sealing without the use of other sealing means.

It is preferred that the backing to which the adhesive coating is united be a transparent, flexible, non-fibrous film of gelatinized cellulosic material, such as regenerated cellulose (as normal or unwaterproofed "cellophane"), cellulose esters (as cellulose nitrate and cellulose acetate), cellulose ethers (as ethyl cellulose), or composites of such materials as, for example, a film of regenerated cellulose coated on one or both surfaces with a waterproofing film of a cellulose derivative (as a cellulose ester or ether). However, I may utilize backings comprised of materials other than gelatinized cellulosic materials, and which are either non-fibrous or are coated with non-fibrous films (preferably water-

proof) composed of cellulosic or other suitable material, including varnishes, lacquers, etc.

In its preferred form my invention is particularly applicable to transparent films of gelatinized cellulosic materials, such as regenerated cellulose, which is clear, transparent and lustrous. This may be made by forming an alkali cellulose compound, properly aged, of wood pulp or cotton liners, then xanthating to prepare viscose with carbon bisulfide and after careful filtration and clarifying by removing air or solid particles, casting the viscose in a coagulating bath of sulfuric acid and sodium sulfate. The film so cast is desulfurized, bleached, softened with glycerine, and then dried.

The regenerated cellulose film so produced may be waterproofed either on one side or on both sides, with a suitably compounded thin film of nitro-cellulose, cellulose acetate, cellulose ether, and similar cellulosic compounds. It will be understood that the waterproofing ingredients may include oxidized oils, varnishes and lacquers. The primary requisite is the application of these waterproofing films so as not to impair the lustrous and transparent characteristics of the sheet formed and to overcome any tendency to provide a warped sheet by the waterproofing layer that may be applied. Additionally, coatings such as transparent rubber, synthetic resins, and like materials may be used as a waterproof coating.

Where transparency of the adhesive tape is not of major importance, but where it is desired to provide a flat, unwarped exposed brilliant and lustrous surface, I have determined that an adhesive coating may be applied to the cellulosic film of the character previously enumerated and obtain a composite in which the adhesive is unified thereto, and in elastic equilibrium with the film, by using a composition made as follows:

Example A

A rubber compound and a tackiness augmenting agent in the form of a synthetic resin are used. Proportions suitable for ordinary temperate climates may comprise:

	Pounds
Plasticized, first quality plantation rubber, such as clear crepe or smoked sheets	10
Cumaron gum or resin	2
Zinc oxide pigment	½

The cumarone gum or resin is an artificial resinous material coming under the group name of cumarone and indene resins, which is the polymerization product of coal tar derivatives. The above ingredients are compounded on a rubber rolling mill to a plastic condition and then cut to desired body or consistency, using a rubber solvent such as benzol or a petroleum solvent, such as high test gasoline. In lieu of a synthetic resin, I may employ a low melting point natural resin, e. g., Burgundy pitch or pine oil foots. Burgundy pitch is soluble in both alcohol and benzol.

Example B

	Pounds
Plantation rubber	2
Mexican or wild rubber, high in natural resin content	5
Zinc oxide pigment	1

The ingredients above enumerated are compounded on a rubber mixing roll and then cut to the desired consistency in a rubber solvent, based upon the necessary viscosity for spreading this material.

It will be understood that the examples above given are for the purposes of getting the requisite adhesiveness in temperate climates. An increase in resinous material or wild rubber may be made for material to be used in colder climates, and in warmer climates the resin component may be reduced.

The resinous component may also be varied in its characteristics in its reactions to solvents by choice of the resinous material. Thus, for purposes of removal of the adhesive tape from some body to which it may be applied, the adhesive may be made so as to have a resin constituent which is soluble in a desired organic solvent, such as benzol, gasoline, acetone or alcohol. Thus, where it is desirable to make a surgeon's tape which is rendered removable by the application of alcohol, an alcohol soluble resin is added in the examples above cited. Such resin may be Burgundy pitch. This will permit alcohol to be used in removing a piece of adhesive tape from any surface, such as from the skin of a patient, by merely applying alcohol to the adhesive.

The rubber resin compounds in their solvents may be spread upon the backing directly, utilizing a knife spreader to uniformly and equally distribute this material upon the backing. The solvent may thereafter be removed by evaporation, preferably recovering the solvent by some suitable recovery method, leaving the rubber mixture upon the gelatinized cellulosic backing material. The coating so applied is firmly adherent and unified to the backing material and provides a normally tacky and pressure sensitive adhesive coating of a unified character, without in any way curling or warping the transparent gelatinized cellulosic film.

Where it is desired to obtain a clear composite of backing material and adhesive, the adhesive preferred by me for this purpose may be made as follows:

Example C

	Parts
Rubber (double break down latex crepe)	200
Para cumarone resin	85
Wood rosin	10
Liquid paraffin oil	5

(All parts are by weight.)

As a variation from the above, where lack of transparency is not objectionable and the addition of a colored hue to the composite of backing and adhesive material desirable, the formula may be varied as follows:

Example D

	Parts
Rubber (latex crepe)	250
Zinc oxide	225
Pine green light colored pigment	25
Wood rosin	137
Liquid paraffin oil	30

This type of adhesive is normally tacky and pressure-sensitive and has a greenish opacity. It will be understood that where a different color is desired to be imparted to the transparent film backing material, the pigmenting material may be correspondingly varied. Coloration in the adhesive may be used to neutralize or vary objectionable shades or colors in the transparent backing material.

If desirable, dyes may be used, particularly to preserve the transparency and attractive sheen of the composite, or the color (pigment or dye), may be added to the backing material itself. In either method of addition, where dyes are desir-

able and particularly for a clear blue transparency, indamine blue is suggested as of value for this purpose; pigmenting may be accomplished by such material as Prussian blue.

The zinc oxide filler, when used, serves as a reinforcing pigment imparting greater coherency and firmness to the adhesive coating. Colored pigments likewise function as reinforcing pigments and thus have a function in addition to that of coloring the adhesive.

In the examples C and D given above, paraffin oil has been included for purposes of plasticizing the rubber. I have found that in order to obtain maximum transparency and the highest possible bond strength and firmness of the adhesive inter se, the paraffin oil may be omitted.

Such adhesive coating, particularly valuable for this purpose, is as follows:

Example E

	Parts
Rosin	160 to 200
Thin latex crepe rubber	250
Beta naphthol	2.5

Approximately 3248 parts of benzol may be added to the above ingredients to provide a readily spreadable cement, and the ingredients may be incorporated in the benzol without the necessity for milling.

In the example given, beta naphthol has been specified and this is primarily used as an antioxidant. This material is desirable in the above formula, as well as in the other formulae given under A, B and C, in that the adhesives are given longer life.

Other antioxidants are desirable and may be included wherever rubber is used in the adhesive. Such antioxidants which may be used are as follows:

(1) Aldol-alpha-naphthylamine.

(2) Phenyl-beta-naphthylamine.

(3) Symmetrical-di-beta-naphthyl-para-diylene-diamine.

In the examples as above given, the proportions are by weight and variation may be made in the primary materials, as well as the quantity of the ingredients. Thus, in the examples given under C, D and E, latex crepe, the rubber component, may be varied by substitution in part or in whole by smoked sheet rubber. Though the synthetic resins, such as cumarone resins above referred to are preferred, various blends of other synthetic resins may be utilized, in part or in whole. To a certain extent, the wood rosin may be substituted by various grades of gum rosin.

In making the adhesives, the rubber base and the resin base determine the tackiness exhibited by the finished product. This relationship, also coupled to a certain extent with the treatment given to the rubber, determines this factor.

In producing a clear adhesive, the relationship of plasticizer (above listed in the form of liquid paraffin oil) and resinous material may be considered as constituting the tack producing phase of the adhesive and up to a certain point the greater the quantity of the tack producing phase that is added to the rubber, the greater the tackiness exhibited in the rubber base adhesive.

In general, for every two parts of rubber base, by weight, one part by weight of the tack producing phase may be added. As indicated above, the resinous content may be varied to increase or decrease the tackiness. However, in order to provide a unified adhesive, satisfactory for purposes of unwinding of the tape from rolls, the resinous content must be retained within certain limits beyond which the adhesive is likely to offset at normal atmospheric temperatures.

In the formulae above cited, double break down latex crepe rubber has been referred to and the treatment of this product alone, as well as the addition of the tack producing phase therewith, will control the characteristics of the adhesive layer. Thus, double break down latex crepe, as contemplated by me above, results from milling latex crepe rubber for approximately fifteen minutes to plasticize the same, with or without heat, and after aging for twenty-four hours, is again plasticized in a mill. At this stage, the material is suitable for addition to the material constituting the tack producing phase. This may be accomplished as follows:

Method A.—200 parts of rubber (double break down latex crepe from the rubber mill as above described) are placed in an internal mixer where the para cumarone resin, wood rosin and paraffin oil (where this is used) are gradually added during the mixing operation to thoroughly incorporate the same into the rubber. No solvent need be used if the mixer is powerful enough to knead these resinous materials into the rubber. When this dry mixing has been thoroughly accomplished, a rubber solvent, such as heptane or benzol, is introduced while the internal mixer is maintained in operation. This action is continued until complete solution results. The quantity of solvent added is in accordance with the means to be employed for spreading this material upon the backing material.

Method B.—200 parts of rubber (preferably double break down latex crepe as above made) are placed in a stirring equipment where paddles agitate the solvent and other ingredients into solution. When 200 parts of rubber have been placed into this mixer, the agitating member is started and a quantity of rubber solvent, such as heptane or benzol, is added to dissolve the rubber. The resinous materials in this particular example, para cumarone resin, wood rosin and the liquid paraffin oil (where this is used), are dissolved in a separate mixer, using an additional quantity of solvent, for example heptane or benzol. When these parts are uniformly distributed and in solution, the parts from each mixer are combined. The quantity of benzol or other solvent is calculated in accordance with the method which may be used for spreading it upon the backing material. The solvent is evaporated after coating or spreading of the adhesive upon the backing material.

In use, the adhesive as above described may be directly applied to the backing or sheets of transparent gelatinized cellulosic materials, previously enumerated, and forms a desirable product.

Where considerable unification is desired between the adhesive layer and the backing material, to assure proper anchorage of the adhesive layer with the backing material, thereby assuring satisfactory unwinding or separation when the composite is formed into rolls or stacks, it is preferred to first coat the sheet of gelatinized cellulosic material with a priming composition. Priming on one surface is particularly effective with sheets formed of regenerated cellulose. The priming operation consists of first coating the backing material before application of the adhesive materials previously described.

The priming composition as preferred by me is a solution of a rubber resin mixture in an or-

ganic solvent in which the solid materials may be varied from 15 to 50% with 85 to 50% of the solvents used. Preferably the solids constitute about 17% of the solution so prepared.

Primer No. 1

A preferred composition comprises:

	Parts
Rubber (latex crepe)	2
Resin (such as pine pitch or wood rosin)	4
A filler, such as whiting (optional)	1

These two or three ingredients, as listed, constitute the solid components in the priming mixture above enumerated.

It is preferred that the deposition product resulting from coating with the priming composition be one whose solid components retard the solvent action of the overlying material when coated thereon as a solution. That is, the solids which may be contained and are present in the primer composition are of such nature that after deposition they are difficultly soluble (only slowly dissolved) in the solvent used for plasticizing and coating the adhesive layer. In the example above given, such properties may be imparted to the deposition product by utilizing rubber which has been partially vulcanized, plasticizing in a mixing device such as an internal mixer in the presence of heat, sufficient to render the mass sticky and to cause the ultimate primer coating to have a strong bonding action. As an additional operation, a solvent retardent may be added. Though whiting is illustrated, other fillers may be used, such as zinc oxide, which serve as reinforcing pigments to give greater coherency and firmness, in addition to any solvent retarding action which they may have.

Though it is indicated that high grade vulcanized rubber, plasticized to tackiness, may be utilized with some degree of success in the example above cited and identified as Primer No. 1, it is preferred, particularly where transparency is desired, to use the combination of ingredients above identified, and to merely add during the mixing operation the requisite quantity of sulphur and accelerators. The quantity of these ingredients, if any, is merely sufficient to render the rubber component difficultly soluble in the solvent present in the solution of the adhesive composition, so made for spreading purposes, without reducing the quality of this priming coat to unify with the adhesive layer superimposed thereover.

Primer No. 2

Rubber, in the form commonly referred to as latex crepe, with the resin content in the proportions above indicated, has added thereto sulfur and accelerators. These are vulcanized with heat after intimate admixture and, while in the softened condition, are mechanically milled until a sticky mass, soluble in benzol or naphtha, is obtained. The amount of benzol or naphtha added is to obtain the requisite fluidity and these solvents may be added to the solid components in quantities of from 50 to 85% as compared with the rubber and resin content.

The primers above described under 1 and 2 may be further rendered resistant to the solvent action of the overlying adhesive to be applied in a subsequent step, by the use of "Vulcoloc" as a superimposed priming composition. This material is, to the best of my knowledge, a reaction product of rubber and a sulphur bearing acid. Vulcoloc may be applied directly to the backing material prior to the application of the solution of adhesive material. Application of an organic solution of the adhesive does not affect the coating of the Vulcoloc primer as applied.

A material which is suitable as a substitute for rubber in the primer, is an artificial or synthetic rubber known as "Duprene" ("Neoprene") which is a polymerized diolefine compound.

Additional examples of transparent primers which anchor the adhesive coating to regenerated cellulose such as Cellophane, whether waterproofed or untreated (ordinary), and to films of cellulose derivatives (such as cellulose acetate, cellulose nitrate and ethyl cellulose), etc., are as follows:

Primer No. 3

	Parts
Selected tube reclaim rubber	90
Latex crepe rubber	10
Whiting	40
FF wood rosin	140

Primer No. 4

Selected inner tube reclaimed rubber treated further to remove pigment	90
Latex crepe rubber	10
FF wood rosin	140

In the above examples, still better results will be obtained by using, in place of FF wood rosin, a heat-treated wood rosin known as "Solros" wood rosin.

The reclaim rubber and latex (and whiting or other reinforcing pigment when used) are compounded together on the ordinary type of rubber mill and milled for 30–40 minutes. This milled base is then transferred to a heavy duty internal mixer (such as a Baker Perkins Mogul type mixer) and milled for 1–2 hours with 10–20 lbs. steam pressure in the heating jacket. The rosin is then added and mixing is continued for another hour. The jacket steam is then turned off and the mass cooled. The requisite amount of solvent (heptane or benzol for example) is then added, preferably in amount equal to 4–5 parts by weight per part of reclaim rubber. Mixing is continued, generally for about ½ hour, until the whole mass is homogeneous. The resulting primer composition or solution is then ready for application to the backing.

In this method of compounding, the reclaim rubber becomes plasticized by the mechanical working in the presence of heat and air, and is further plasticized by the rosin which is thoroughly incorporated with the rubber.

The reclaim rubber is superior to raw rubber, for use in the primer, for several reasons, including: The primer coating is rendered difficultly soluble in the rubber solvent contained in the subsequently applied adhesive solution, because the reclaim rubber is in a partially vulcanized state which greatly decreases the rate of solution in rubber solvents. The primer coating has a greater bonding action, i. e., becomes more firmly unified to the backing and to the adhesive coating, due to the higher adhesion value of the reclaim rubber resulting from the heating cycle and amount of break down experienced in the reclaiming process. These features are obtained without sacrifice of firmness or coherency of the primer coating, due to the high cohesiveness of the reclaim rubber resulting from its prior vulcanization. If raw rubber were subjected to the same treatment, it would have softness and stickiness but would lack adequate cohesiveness.

The reclaim rubber above referred to in the

formulae for making the primers is preferably made as follows:

Light colored inner tube stock may be utilized, though other forms of culcanized rubber may be used. Where inner tube stock is used, it is chopped up on mill rolls, preferably of the type utilizing breaker members, simulating heavy gear teeth. Rolls of this character operate in pairs, the top one being free to move up and down, while the lower one is stationary. Relative rotation of these rolls serves to chop up the scrap. After the scrap is chopped and torn apart, it is fed to the breakers, which pulverize it further, whereupon it is then passed over a screen and the fine particles separated out. The coarse particles are recirculated through the breakers until they also go through the screen. The fine particles are then charged into horizontal digestors, where they are treated with caustic soda solution, the heating of the stock being carried out under a steam pressure of about 40 pounds while being agitated. This treatment is carried out from 8 to 24 hours, to remove all fibres and free sulfur, and to plasticize the rubber. After digestion as above described, the stock is washed with water until practically free from caustic. The stock is then charged into a continuous belt drying system, where it is dried at a rather low temperature. The stock is then ready for the mill room, where the first operation is to mass these small particles together on a large mill. After consolfdation on the large mill, the rubber is then run through refiners, which cause grinding and crushing of any hard particles in the stock. The product is then passed through a strainer in which the rubber is extruded through heavy mill screens into small rod-like forms, after which they are massed together into sheets or slabs.

In some cases the procedure above described may be slightly varied, for example, when certain types of inner tube reclaim are desired, the pulverized scrap is heated in the presence of steam alone, without any caustic. It is thereupon, after being heated, sent directly to the mill room, without any further treatment.

In general, the primer layer is one which makes satisfactory bond with the regenerated cellulose backing material, or the gelatinized cellulosic material constituting such backing material, which may include a waterproofing layer of cellulosic compounds. Such primer may be a layer of a synthetic resin, such as one of the group of polyhydric-alcohol polybasic-acid resins, which makes excellent union with gelatinized cellulosic materials and with rubber. In the event that it is desired to wholly eliminate the above types of primer layer and waterproof the backing material of regenerated cellulose, where this is used, the waterproofing layer over the regenerated cellulose backing material is one which has affinity for the adhesive coating so that the adhesive coating makes better anchorage than would be the case if the regenerated cellulosic film were used alone. Such waterproofing materials which have a primer function, may be a highly plasticized nitrocellulose or cellulose acetate, oxidized and gelatinized drying oils, synthetic resins, such as phenolic condensation resins, or those of water white characteristics, such as urea resins. Those ingredients are chosen, as above indicated, which will be difficultly soluble in the solvent used in the solution of the adhesive layer composition subsequently applied thereto, so as not to result in a weakened structure preventing proper unification between the adhesive coating and the backing material.

Where nitrocellulose is used for the waterproofing layer, it may be highly plasticized by resinous material, which may be used in the proportion of 67–50% to 33–50% of nitrocellulose material. The following is given as an example of a solution which when applied to the regenerated cellulose backing, will form a coating of this type upon evaporation of the solvents:

	Parts
Nitrocellulose, such as "½ second cotton"	9
Xylol	15
Cellosolve (ethylene glycol monoethyl ether)	10
Resin, such as "Rezyl 12" (a condensation product of castor oil and phthalic anhydride)	12
Dammar cut (a solution of 40% dammar resin and 60% benzol)	16

The method of application of the coating materials above described will, to a large extent, depend upon the character of the coating. The primer and adhesive coatings may be successively applied where these are used in solutions of volatile solvents, by an offset process from rollers uniformly coated with the primer compositions or the adhesive composition. With the more viscous composition of either primer or adhesive, these papers may be coated upon the backing by a knife spreader. For the more plastic form of either composition and where unification is desired, calendering or frictioning of these materials may be resorted to, to apply either the priming coat, or the adhesive coat or both.

As an example of one method which may be followed in preparing the composite, the following procedure is recommended. A web of regenerated cellulose film of the desired thickness (which may have been printed on the face receiving the primer) is carried through a set of vertically positioned squeeze rolls. The lower roll has transferred to it, or dips into, the solution of the primer composition. A uniform layer of primer is applied at this point to the film or web of backing material. The web thus prepared travels from the squeeze rolls, to a duct for removing and drying off the solvents in the primer. The web then is directed to a contrivance for coating, at which point a doctor knife or coating knife is used to spread a film of the composition of adhesive material. The composition is directly applied over the primer and the composite as coated is either hung in festoons or travels through a drying duct, at which point sufficient time is allowed for complete removal of the solvent, and to form the deposition product to the desired consistency, due to the solid components present, for tackiness. If heat has been utilized to separate the solvent from the deposition product resulting in the adhesive, the composite thus formed may be cooled and brought to room temperature, to render the product in more convenient form for stacking or winding into rolls. Where wound into rolls, the composite thus formed is then cut or converted into small rolls, suitable for trade requirements.

The adhesive composition as deposited upon the film as heretofore described is one which is normally tacky and pressure-sensitive. It is of particular utility in connection with the lustrous, highly polished backing material described, in that the adhesive layer is in equilibrium with it and will not alter or warp its appearance. As indicated, the adhesive layer is unified in that it

has great adhesion inter se (coherence) and when applied forms a unified product with the backing material. When wound into rolls or formed into stacks, the lustrous surface of the backing will not be modified, no offsetting will occur and ready separation is assured of the entire composite from its adjacent layer.

Where the product may encounter low humidities or low temperatures, it may be desirable to coat the back side of the backing material with a protective coating, such as a thin film of glycerine. In such event, a protective coating is applied which is not disintegrated by or which does not interfere with the adhesive action of the adhesive layer. It will be understood, however, that under ordinary conditions, the composite of backing material and adhesive layer as hereinbefore described is a complete unified product and no further treatment need be made.

The foregoing adhesive coatings are characterized by being water-insoluble and in themselves make for a waterproofing of the underlying base.

Primer No. 5

Casein	3 to 8 pounds, preferably 5 pounds
Water	9 to 40 pounds, preferably 30 pounds
Concentrated ammonium hydroxide	1 to 8 pounds, preferably 3 pounds
Rubber latex (preferably 60% concentration)	3 to 25 pounds, preferably 16 pounds

The characteristic features of the above primer are that it is compatible with the backing material where it is regenerated cellulose, such as Cellophane, flexibilized with glycerine, or such cellulosic material including the cellulosic compounds previously enumerated, coated with waterproofing materials, and is also compatible with any of the previously mentioned water-insoluble pressure-sensitive adhesive coatings.

In the formula of Primer No. 5, I have referred to the use of casein in connection with rubber latex. The casein is more or less water-soluble, especially in the presence of the ammonium hydroxide, and not only facilitates anchorage to glycerine-treated Cellophane when this is used as the backing, but is also compatible with the water-soluble type of adhesive coating when the priming coat is finally dried. This water-insoluble material, as included in the primer, may be supplemented by or substituted by glue, isinglass or gelatin, and other similar water-soluble materials, which not only facilitate the dispersion of the latex but also include the feature of being compatible with water-soluble materials. It will further be noted that though in the preferred form of the primer, where casein is used, it is preferred to use ammonium hydroxide in order to facilitate the solution of the casein, the quantity of ammonium hydroxide may be reduced where other water-soluble materials are used, and merely sufficient ammonium hydroxide is used to prevent untimely separation of the solids of the rubber latex.

The rubber included in the emulsion type of primer is for purposes of having some material compatible with the water-insoluble adhesive coating and water-insoluble backing, and while I have specified in my preferred form of primer the inclusion of a dispersion of rubber latex, dispersions of natural and synthetic resins, particularly those which will give a clear and colorless or water-white residium, may be substituted for the latex.

In general my emulsion type primer may be characterized as a double phase primer to the extent that it includes emulsified ingredients of both water-soluble and water-insoluble characteristics, in dispersed form.

It will be understood that in the application of the primer to the backing material, drying is effected after coating, before the adhesive coating is applied.

The use of water-soluble pressure-sensitive adhesive coatings is described in more detail in parent application Ser. No. 675,291, filed June 10, 1933, and in my companion application Ser. No. 191,261, filed of even date herewith.

The use of a plasticized rubber primer is claimed in my application Ser. No. 191,260; and the use of a cellulose-derivative backing in my application Ser. No. 191,264; both filed of even date herewith.

What I claim is as follows:

1. An adhesive sheet comprising a transparent flexible non-fibrous film backing having smooth lustrous surfaces and a non-offsetting normally tacky and pressure-sensitive water-insoluble adhesive coating firmly united to said backing, said adhesive including a coloring material visible through the backing so that the back surface has a lustrous colored appearance.

2. An adhesive sheet comprising a transparent flexible film backing having non-porous surfaces, and a flexible water-insoluble adhesive coating having a rubbery base and so composed that it is non-offsetting and normally tacky and pressure-sensitive, said adhesive coating being firmly united to said backing and the adhesive and backing being of such kinds that the back surface is inactive to the adhesive coating to a degree permitting unwinding of the adhesive sheet from rolls thereof without delamination or offsetting of adhesive, and the adhesive including a coloring material visible through the backing.

3. An adhesive sheet comprising a transparent flexible non-fibrous cellulosic film backing and a non-offsetting normally tacky and pressure-sensitive water-insoluble adhesive coating containing a reinforcing and coloring pigment firmly united to and visible through said backing, the back surface of the backing being lustrous and inactive to said adhesive coating to permit removal or unwinding from stacks and rolls without perceptible offsetting of adhesive.

4. A transparent adhesive sheet comprising a non-fibrous transparent flexible film backing having non-porous surfaces and a water-insoluble normally tacky and pressure-sensitive transparent flexible adhesive coating, said adhesive coating being firmly united to said backing and the adhesive and backing being of such kinds that the back surface of the backing is inactive to the adhesive coating to a degree permitting unwinding of the adhesive sheet from rolls thereof without delamination or offsetting of adhesive.

5. A transparent adhesive sheet comprising a non-fibrous transparent flexible film backing having non-porous surfaces and a water-insoluble transparent adhesive coating having a rubbery base and so composed that it is non-offsetting and normally tacky and pressure-sensitive, said adhesive coating being firmly united to said backing and the adhesive and backing being of such kinds that the back surface of the backing is

inactive to the adhesive coating to a degree permitting unwinding of the adhesive sheet from rolls thereof without delamination or offsetting of adhesive.

6. A transparent adhesive sheet comprising a non-fibrous transparent flexible cellulosic film backing having non-porous surfaces and a water-insoluble transparent adhesive coating having a rubbery base and so composed that it is non-offsetting and normally tacky and pressure-sensitive, said adhesive coating being firmly united to said backing and the adhesive and backing being of such kinds that the back surface of the backing is inactive to the adhesive coating to a degree permitting unwinding of the adhesive sheet from rolls thereof without delamination or offsetting of adhesive.

7. A transparent adhesive sheet comprising a non-fibrous transparent flexible regenerated cellulose film backing having non-porous surfaces and a water-insoluble transparent adhesive coating having a rubbery base and so composed that it is non-offsetting and normally tacky and pressure-sensitive, said adhesive coating being firmly united to said backing and the adhesive and backing being of such kinds that the back surface of the backing is inactive to the adhesive coating to a degree permitting unwinding of the adhesive sheet from rolls thereof without delamination or offsetting of adhesive.

8. An adhesive sheet comprising a transparent flexible non-fibrous cellulosic film backing having smooth lustrous surfaces and a water-insoluble normally tacky and pressure-sensitive non-offsetting transparent rubber-resin type adhesive coating firmly united to said surface, the composite sheet being transparent.

9. An adhesive sheet comprising a regenerated cellulose film having united thereto a waterproofing coating comprising a cellulose ester highly plasticized with a synthetic resin and providing a smooth non-fibrous surface, and a water-insoluble normally tacky and pressure-sensitive non-offsetting rubber-resin adhesive coating united to said surface, the parts of the composite adhesive sheet being transparent, and so firmly united together that the adhesive sheet may be unwound from rolls without delamination or offsetting of adhesive.

10. An adhesive sheet comprising a transparent flexible non-fibrous film having non-porous surfaces, a coating thereupon of a non-offsetting transparent normally tacky and pressure-sensitive water-insoluble adhesive, and an interposed transparent primer coating unified both to said surface and to said adhesive coating, the composite sheet being transparent and its parts so firmly united that it may be unwound from rolls thereof without delamination or offsetting of adhesive.

11. A transparent adhesive sheet comprising a non-fibrous transparent flexible film backing having non-porous surfaces, a water-insoluble transparent adhesive coating having a rubbery base and so composed that it is non-offsetting and normally tacky and pressure-sensitive, and an interposed transparent flexible primer coating firmly bonding said adhesive coating to the backing, the adhesive sheet having its parts so firmly united that it may be unwound from rolls thereof without delamination or offsetting of adhesive.

12. A transparent adhesive sheet comprising a non-fibrous transparent flexible cellulosic film backing having non-porous surfaces, a water-insoluble transparent adhesive coating comprised of raw rubber blended with a compatible tack-producing resin in proportions such that the adhesive coating is non-offsetting and normally tacky and presure-sensitive, and an interposed flexible transparent primer coating firmly bonding said adhesive coating to said backing.

13. An adhesive sheet comprising a transparent non-fibrous cellulosic film backing, a coating thereupon of a non-offsetting normally tacky and pressure-sensitive water-insoluble adhesive containing a coloring material, and an interposed transparent primer coating unified both to the backing and to said adhesive coating, the adhesive being visible through the backing and causing the back surface of the backing to have a colored appearance.

14. An adhesive sheet comprising a transparent flexible non-fibrous film backing, a coating thereupon of a non-offsetting normally tacky and pressure-sensitive water-insoluble adhesive containing a coloring material, and an interposed transparent primer coating bonding said adhesive coating to said backing, the adhesive being visible through the backing and causing the back surface of the backing to have a colored appearance.

15. An adhesive sheet comprising a non-fibrous flexible film backing having non-porous surfaces and a water-insoluble normally tacky and pressure-sensitive flexible adhesive coating, said adhesive coating being firmly united to said backing and the adhesive and backing being of such kinds that the back surface of the backing is inactive to the adhesive coating to a degree permitting unwinding of the adhesive sheet from rolls thereof without delamination or offsetting of adhesive, said adhesive sheet transmitting light so that the sheet will not conceal the coloring or markings of surfaces to which applied.

16. An adhesive sheet comprising a non-fibrous flexible film backing having non-porous surfaces, a water-insoluble normally tacky and pressure-sensitive flexible adhesive coating, and an interposed flexible primer coating firmly bonding said adhesive coating to the backing, the adhesive and backing being of such kinds that the back surface of the backing is inactive to the adhesive coating to a degree permitting unwinding of the adhesive sheet from rolls thereof without delamination or offsetting of adhesive, said adhesive sheet transmitting light so that the sheet will not conceal the coloring or markings of surfaces to which applied.

RICHARD GURLEY DREW.

June 1, 1943. A. E. MAIBAUER 2,320,442

ELECTROPLATING EQUIPMENT

Filed July 28, 1939

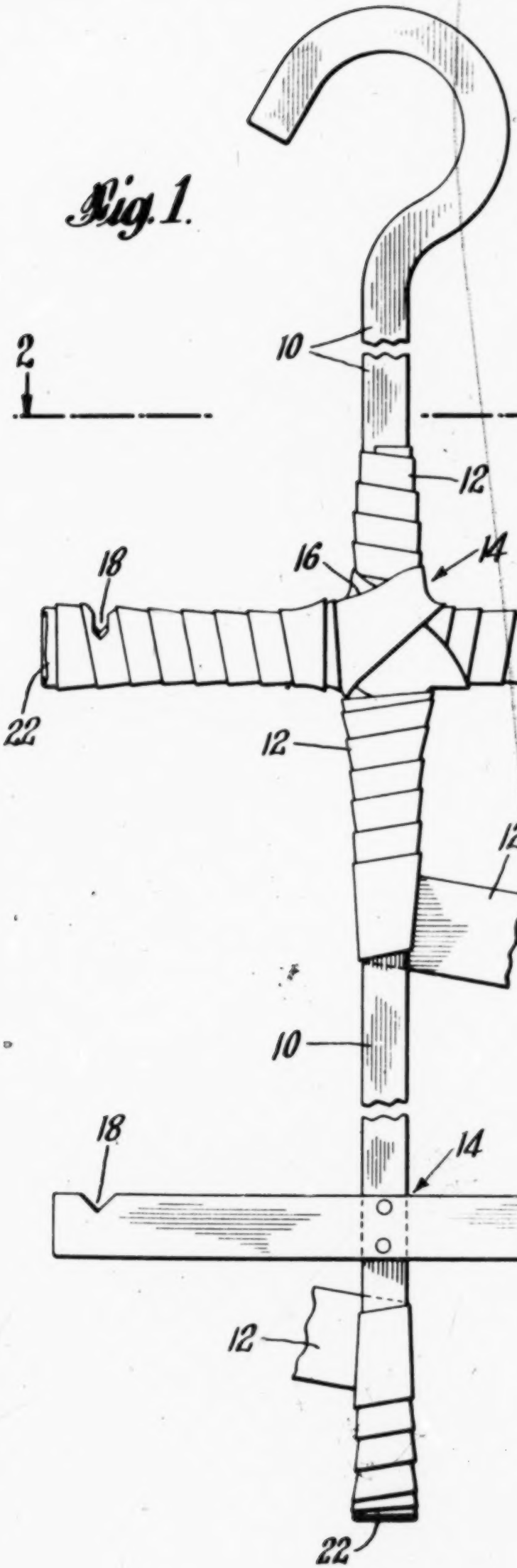


Fig. 1.

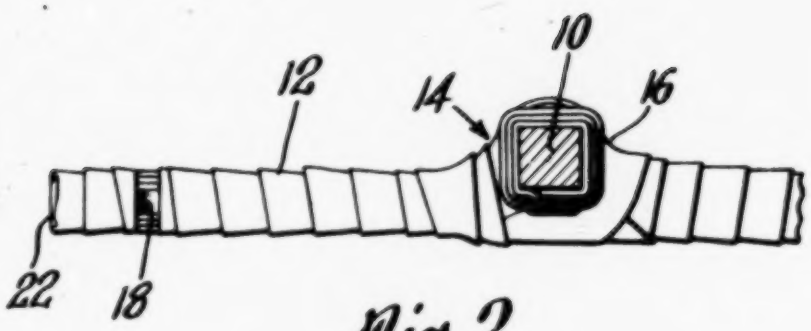


Fig. 2.

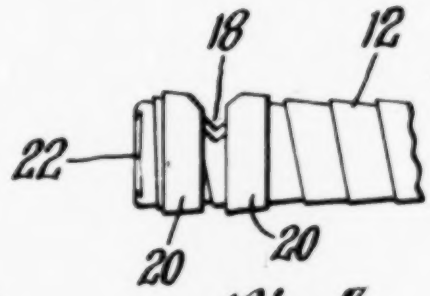


Fig. 3.

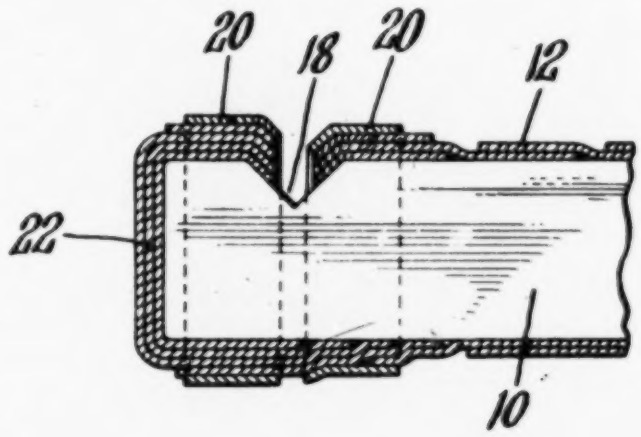


Fig. 4.

INVENTOR
ALBERT E. MAIBAUER
BY
ATTORNEY

Patented June 1, 1943 2,320,442

UNITED STATES PATENT OFFICE

2,320,442

ELECTROPLATING EQUIPMENT

Albert E. Maibauer, Travis, Staten Island, N. Y., assignor, by mesne assignments, to Union Carbide and Carbon Corporation, New York, N. Y., a corporation of New York

Application July 28, 1939, Serial No. 287,054

6 Claims. (Cl. 204—297)

This invention relates to the art of electroplating and electroplating equipment and insulation therefor.

From outward appearances the electroplating of an object is relatively simple as the object to be plated is merely suspended in a conducting bath of electrolyte and an electric current is passed between the electrodes, one of which is the article to be plated, whereupon the plating metal is deposited upon the article. In commercial practice, however, electroplating is a procedure which requires extremely close attention and fine regulation to produce an acceptable plated deposit in view of the complicated chemical reactions taking place within the electrolyte as well as at the electrodes; for example the composition of the electrolyte must be maintained within close limits and variations in the temperature, current density, etc. change the character of the deposit.

In commercial electroplating a number of the objects to be plated are frequently affixed to a rack of a conducting metal and the entire rack is immersed in the plating bath. It is a practical necessity that the racks be insulated else the plating process cannot satisfactorily be controlled and will be uneconomical as the plating metal will deposit on the rack which wastes the plating metal and current used to deposit it, shortly renders the rack unserviceable and renders it difficult for the plater to determine how much of a deposit has occurred on the articles which it was intended to plate. Among other difficulties, the metal of an uninsulated rack may dissolve in the plating bath and ruin it.

Various insulating media for racks have been tried and described in the literature. These include lacquers and it would seem relatively simple to insulate a rack merely by dipping it into an insulating lacquer or varnish or spraying or painting the lacquer on the rack and then permitting the coating to harden. In practice, however, lacquers leave much to be desired from the standpoint of economical application to the racks and operation of the racks after the lacquer is applied. Lacquers and varnishes usually contain volatile solvents for the gums or resins which deposit when the solvent evaporates, but the evaporation of the solvents may leave pin holes in the coating and thus numerous applications of the lacquer are frequently required and between each application it is often necessary to process the rack very carefully by air-drying and baking (see the United States patent to Herzog No. 2,072,170, March 2, 1937), as any solvent remaining in the coating will expand and form blisters which eventually disrupt the coating. Even with this care the coated rack is not as satisfactory as is desired since the coating may be uneven; it is difficult to apply an even coating by spraying or painting and when a dipped rack is hung up to drain the coating is always thinner on the upper parts of the rack and on the upper surfaces of the rack bars than on the lower. Thus a lacquer coated rack is not the ultimate in such devices.

With regard to the materials used for coating the racks there are numerous desiderata among which are that the coating material must not contaminate the bath and it must be as tough as possible, be substantially unaffected by acids or alkalis, have suitable electrical insulating properties and must maintain these characteristics at relatively high temperatures as well as at low temperatures. One of the most suitable bases for coatings is a copolymer of vinyl chloride or vinyl benzene and vinyl acetate containing from 50% to 95% of vinyl chloride or vinyl benzene and from 50% to 5% of vinyl acetate. Other vinyl halogen esters or vinyl aryl esters and vinyl esters of the lower aliphatic acids, that is acids containing from two up to five or six carbon atoms may be used. But even these basic materials require modification for the most satisfactory stop-offs. In practical electroplating the racks are subjected to a great deal of rough handling and temperature change and the insulation has to withstand all of these. For instance, the racks are subjected to abrasion when they are handled after insulating and during use and they are subjected to hot electrolyte and hot cleaning solutions and cold water washes, yet the insulation must not break through nor loosen from the rack during the handling nor may it crack when it is subjected to cold water while the metal of the rack is hot and in an expanded condition nor may it loosen from the rack when it is subjected to hot electrolyte while the rack is still cold and in a contracted condition. Another difficulty with using an unmodified vinyl copolymer is that the baked, unmodified copolymer is in a harder, more brittle and stiffer condition and the coated rack is less satisfactory for practical use.

The accompanying drawing shows a plating rack embodying my invention. In the drawing,

Fig. 1 is an elevation of a partially insulated rack;

Fig. 2 is a section on line 2—2 of Fig. 1, viewed in the direction of the arrows;

Fig. 3 is an elevation of an end of a cross arm of a plating rack, showing extra turns of tape at the end of the cross arm and at the contact point; and

Fig. 4 is an enlarged vertical section through the arm of Fig. 3.

According to one aspect of the present invention I overcome the difficulties experienced with prior stop-offs by covering the plating rack 10 with an insulating tape 12, the composition of which is important and includes the modified copolymers of vinyl compounds. The tape contains no readily volatile solvents and is not porous nor do pin holes develop in it; thus the electrolyte does not contact the rack. The tape is elastic and has elastic recovery so that when wrapped around the rack under tension, it contracts and presses against the parts of the rack with such pressure that the electrolyte cannot seep between the insulation and the metal of the rack. The tape also has such flexibility and yield that when it contracts onto the parts of the rack any irregularities in the rack, for instance nodules or tool marks are covered or filled in, thus permitting the use of a rack which is merely a rough casting or a roughly machined part. The tape is a decided improvement over a lacquer which would produce an extremely thin coating, if any, on the point of a nodule or on the ridge or burr left by rough machining. Furthermore, the preferred tape has the characteristic that one edge can stretch without stretching the other edge or can stretch more than the other edge and this, in conjunction with the elastic recovery, permits the tape to be wound around angles 14 in the rack and give a smooth non-puckering edge 16 on the short side of the turn. The elastic recovery of the tape also obviates the necessity of using primer coatings on the rack which have heretofore been required to make lacquers of the vinyl copolymers adhere to the metal of the rack, as the tape contracts around the rack bars and remains in place on the bars even though there is no primer. Another feature of the tape is that it does not lose its elasticity and elastic recovery even though heated and cooled and this is of distinct advantage when the racks are submitted to alternate heating and cooling as the tape will hug the metal of the rack and remain sealed against it when the rack is transferred between a hot electrolyte or cleaning bath and a cold wash water. A further advantage of a contractible tape is that at certain parts 19 of a rack, for instance where the article to be plated (or its support) makes electrical contact with the rack, it may be necessary for the insulation to be broken, and extra wrappings 20 of the tape may be applied next to these breaks to force the tape against the rack with greater than usual pressure to prevent the electrolyte from working in between the insulation and rack. In addition to the foregoing features a rack may be insulated more thoroughly, easily and quickly with tape than with lacquer. With a tape it is necessary only to wrap the rack with the tape, preferably with the edges of successive convolutions of the tape overlapping. This may be done very quickly and easily and all surfaces of the rack may be insulated equally and thoroughly whereas with a lacquer the tops of the rack bars and the points of the nodules as well as other parts where the lacquer runs off, have extremely thin insulating coverings. The tape may be and preferably is sufficiently thick, say from 5 to 15 mils, that a single wrapping on the majority of the rack is all that is necessary but a further advantage of tape as compared to lacquers is that several tape layers may expeditiously be applied where desirable, for instance where the breaks 18 in the insulation are necessary for contact purposes and at the corners 22 of the racks where abrasion and other mechanical injury may occur. An electroplating rack has been used to illustrate this phase of the invention but the tapes may also be used with other articles of electroplating equipment which are in the form of bars or tubes so that they may be wrapped and advantage taken of tapes as distinguished from lacquers and large sheets used to cover flat surfaces; in fact the characteristics of the tapes, previously referred to, which give them a decided advantage over lacquers on surfaces which can be wrapped are somewhat of a disadvantage or are of no benefit if large sheets are applied to flat surfaces as the sheets, if applied under tension, would draw away from the edges of flat surfaces leaving the edges exposed to the electrolyte, and also the elastic recovery of the material is of no advantage in holding a sheet against a plane surface to prevent electrolyte or cleaning solution from working in between the surface and the sheet.

With regard to the composition of the tapes, they are, as previously stated, based on the vinyl copolymers, but these require modification for the most satisfactory stop-offs to obtain the maximum desirable physical and chemical characteristics noted herein and a minimum sealing temperature. As the unmodified copolymers increase in molecular weight due to polymerization, thin films thereof become increasingly brittle and fragile and the unmodified copolymers also become increasingly hard, stiff and unworkable at ordinary temperatures, and their solubility decreases. If unmodified and in the state of polymerization where they are soluble they may be strong and non-brittle in thick molded pieces somewhat as glass is, but in thin films such as are deposited from lacquer they are quite fragile and easily break and shatter under a blow. Thus racks covered with lacquer films of the unmodified polymers cannot long endure the handling they receive in practical factory use. It is obviously desirable for the best stop-offs to retain the vinyl copolymers in their best operable condition for as long a time as possible. But it is necessary in modifying the vinyl copolymers that the modifying agents be such that they do not contaminate the electrolyte nor substantially affect the plating operation.

I have found that the group of modifiers suitable for admixture with the copolymers to give the composition the desired characteristics is rather limited. In general they should contain an aryl group or lead which contribute to inertness in an electroplating bath, or the phosphate radical which appears to do no particular harm to electroplating baths, or a radical which partakes of the nature of the copolymers. The modifiers should also be insoluble in water. Thus a modifier may be triphenyl phosphate (including thereby homologs) which combines aryl groups with the phosphate radical and is characterized by water insolubility, or an organic phthalate ester for instance a butyl, amyl, etc. phthalate or dibutoxy ethyl phthalate which contain an aryl group, or a lead salt or oxide, for instance lead stearate, lead oxide or lead abietate, which are quite inert, or cyclohexanol acetate which partakes of the nature of the acetate in the copolymer or chlorhydrin phthalate which partakes of

the nature of the chloride of the copolymer and also contains an aryl group.

It has also been found desirable to use a low molecular weight copolymer to modify a high molecular weight polymer. The low molecular weight polymers, when thoroughly incorporated with the high molecular weight polymers, do not render the high molecular weight polymers fragile as would ordinarily be expected but they do enable the overlapping edges of the tapes to seal against one another, this action being assisted by such modifiers as tricresyl phosphate which imparts a certain amount of adhesiveness to the tape particularly at elevated temperatures although leaving the surface substantially non-tacky at room temperatures. Thus the tape is characterized by such a dry surface at room temperature that it does not adhere to a person's hands and can easily be wrapped on a rack yet at elevated temperatures, say from 100° C. to 140° C. or when wet with an adhesive or a solvent for the low molecular weight polymer one surface of the tape will seal against an overlapping tape surface effectively to prevent leakage of the electrolyte between the surfaces. The mechanical contraction of one layer of tape on the other at room temperatures combined with the adhesiveness of the tape surfaces toward each other (even though substantially dry to a person's hands) is sufficient to seal against the electrolyte even at room temperatures but a substantially impervious seal is obtained under the influence of heat, adhesive or solvent as previously described.

Of the modifiers which may be used with the high molecular weight polymers, the low molecular weight polymers plastify the high molecular weight polymers and enable the tapes to seal without substantially affecting other properties, the tricresyl phosphate plastifies while increasing the tackiness of the surface as previously described, the lead compounds stabilize the mixture and the phthalates plastify while leaving the surface dry.

The foregoing and other objects and features of the invention will in part be obvious and in part will be pointed out in the following claims and description of a manner in which the tapes may be made and applied to electroplating racks. It is to be understood, however, that the description is for illustrative purposes only and that the invention is not to be limited strictly thereto.

In making the tape from 90 to 180 parts (by weight) of a copolymer containing 95% vinyl chloride and 5% vinyl acetate and a molecular weight from approximately 22,000 to 24,000, and from 350 to 630 parts of a copolymer containing 80% vinyl chloride and 20% vinyl acetate and a molecular weight of approximately 9,000 (molecular weights being calculated according to the Staudinger formula from dilute solutions of the resins) are thoroughly incorporated with from 140 to 266 parts of tricresyl phosphate, about 30 parts of lead abietate and from 32 to 61 parts of diamyl phthalate, the larger amounts of plastifying modifier being used with the larger parts of the high molecular weight vinyl copolymers to give tapes having such characteristics of elasticity, adhesiveness, softening temperature, etc. as are desired. After thorough incorporation, tapes may be formed from the mass either by extrusion, casting or milling. The tapes from 5 to 15 mils. in thickness and from ½ to 1½ inches in width have been found satisfactory in practical electroplating use but other thicknesses and widths may be used if desired.

In using the tape, the plating rack is merely wrapped with the tape having edges of the turns overlapping, preferably having a plurality of layers on the corners of the racks and on other parts where abrasion may occur as well as adjacent the non-insulated contact areas. While wrapping the rack the tape is preferably held under tension so that it is stretched and thus the tape contracts and presses tightly against the rack. Due to the ability of the tape to stretch more on one edge than on the other and to stretch more at the center than at the edges, a smooth and non-puckered covering may be had on the corners and where side bars join the main stem of the rack, even in the angles of the junctures the freedom from puckers permits a tight seal. After the rack is wrapped it may, if desired, be subjected to heat which softens the tape somewhat although it does not destroy the contraction of the tape on the rack bars. The softening of the tape combined with its contraction causes the overlapping edges to seal against each other. The heat may be applied in any suitable manner for instance by immersing the rack in hot oil or inserting in an oven for a few moments for instance 15 minutes at 245° F. or by fanning with a blow torch. The heat is preferably merely a flash heat sufficient to soften the tape and no prolonged air drying or baking to remove solvent is necessary or desirable and the covering is not porous after the heat treatment. The tapes offer a practical advantage in effecting repairs if the covering becomes broken; for instance a patch of the tape may easily be applied by pressing one end of a section of new repair tape on the old tape which is already on the rack, somewhat beyond the break. The new tape and the old may be united firmly by fanning with a blow torch. The patching tape may then be stretched tightly over the break or wound over the break and while held in position may be sealed in place with the blow torch. Repairs are thus effected very easily and quickly.

As the electroplating racks are almost invariably of metal which absorbs heat quite readily and the tapes do not conduct heat very readily, it will be seen that when a taped rack is subjected to heat, the highest tape temperature will be obtained at the overlapping edges of the tape where there are two thicknesses of tape and where sealing of the tape is desired.

If desired, the taped rack may be given a superficial treatment with a solvent for the low molecular weight component of the tape, for instance acetone or methyl ethyl ketone, or with a lacquer comprising a copolymer and a solvent. The solvent or lacquer softens the exposed overlapping edge and effects a seal but does not affect the tape to any appreciable depth. Thus the main body or interior portion of the tape is not affected and draws the overlapping edges together and any porosity resulting from the evaporation of the solvent is merely on the surface. The solvent or lacquer may be applied in any of the usual ways, for example by spraying, painting or dipping but dipping in a pure solvent or very thin lacquer is preferred and the rack should merely be plunged into the liquid and immediately withdrawn to wet the surface of but not soak the tape, and the solvent should be quickly evaporable as those mentioned above. It may here be remarked that if, for any reason, it is desirable to use a lacquer to coat parts of electroplating equipment, a solution of a soluble copolymer including the previously dis-

closed modifiers has been found to be better than the mere solution of the copolymer.

I claim:

1. Electroplating equipment to be subjected to electrolyte including a part insulated from said electrolyte with a stretched elastic tape consisting essentially of a plasticized copolymer formed from a vinyl ester of an aliphatic carboxylic acid having from two to six carbon atoms with a member of the group consisting of vinyl halides and vinyl benzene, said tape being wrapped under tension on the part with the turns overlapping, the insulation on said part being substantially impervious to said electrolyte.

2. Electroplating equipment to be subjected to electrolyte including a part insulated from said electrolyte with a stretched elastic tape consisting essentially of a plasticized copolymer of vinyl chloride and vinyl acetate, said tape being wrapped under tension on the part with the turns overlapping, the insulation on said part being substantially impervious to said electrolyte.

3. Electroplating equipment to be subjected to electrolyte including a part insulated from said electrolyte with a stretched elastic tape consisting essentially of a plasticized copolymer formed from a vinyl ester of an aliphatic carboxylic acid having from two to six carbon atoms with a member of the group consisting of vinyl halides and vinyl benzene, said tape being impervious to the electrolyte and wrapped under tension on the part.

4. Electroplating equipment to be subjected to electrolyte including a plurality of parts in angular relation to each other and wrapped stretched elastic tape insulation on said parts, said tape consisting essentially of a plasticized copolymer formed from a vinyl ester of an aliphatic carboxylic acid having from two to six carbon atoms with a member of the group consisting of vinyl halides and vinyl benzene, said tape being wrapped on said parts under tension, and the insulation including the copolymer being substantially impervious to said electrolyte and insulating said parts from said electrolyte.

5. Electroplating equipment to be subjected to electrolyte including a part insulated from said electrolyte with a stretched elastic tape consisting essentially of a mixture of high and low molecular weight copolymers formed from a vinyl ester of an aliphatic carboxylic acid having from two to six carbon atoms with a member of the group consisting of vinyl halides and vinyl benzene, said high molecular weight copolymer having a molecular weight between approximately 22,000 and 24,000, said low molecular weight copolymer having a molecular weight of approximately 9,000, said tape being wrapped on said part under tension, and the insulation including said copolymers being substantially impervious to said electrolyte.

6. Electroplating equipment to be subjected to electrolyte including a part insulated from said electrolyte with wrappings of a stretched elastic tape consisting essentially of a plasticized copolymer formed from a vinyl ester of an aliphatic carboxylic acid having from two to six carbon atoms with a member of the group consisting of vinyl halides and vinyl benzene, a substantially water insoluble plastifier for the said copolymers and a stabilizer for the said copolymers, said plastifier and stabilizer being substantially free from deleterious effect on the electrolyte, said tape being wrapped on said part under tension.

ALBERT E. MAIBAUER.

Patented Oct. 19, 1943 2,332,265

UNITED STATES PATENT OFFICE

2,332,265

ADHESIVE SHEETING

Richard F. Schmidt, Cuyahoga Falls, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y., a corporation of New York

No Drawing. Application June 27, 1941, Serial No. 400,145

5 Claims. (Cl. 117—122)

This invention relates to flexible sheeting coated with a pressure-sensitive adhesive and pertains specifically to a transparent tape made from plasticized gamma polyvinyl chloride coated with an adhesive composition comprising polyisobutylene, rubber, and a resinous material.

Pressure-sensitive adhesive tapes with paper or fabric backings have long been known, but it has been hitherto impossible to find an adhesive which is satisfactory for use with a plasticized gamma-polyvinyl chloride backing. There are many advantages to be gained by using polyvinyl chloride, or a polymer in which vinyl chloride is the principal constituent such as a copolymer of vinyl chloride with minor proportions of vinyl cyanide, vinyl acetate or other vinyl ester, vinylidene chloride, or the like. A backing made of one or more of these materials is, without further treatment, waterproof, non-inflammable, resistant to oils and solvents commonly used in paint or lacquer, and extremely resistant to aging by sunlight or air. Moreover, tape made from this material may be produced in a variety of colors, and may be transparent, translucent, or opaque. Because of the high tensile strength of plasticized gamma polyvinyl chloride the film used as backing may be extremely thin without danger of having the tape tear when being removed from a surface to which it has been applied.

I have found that pressure-sensitive adhesives which give satisfactory results with paper or fabric backings are not effective with backings made from plasticized gamma-polyvinyl chloride. Ordinary adhesives either do not adhere well to the polyvinyl chloride backing, or, if they do adhere, they tend to off-set; that is, when the tape is rolled up on itself the adhesive layer tends to stick to the back of the tape below it rather than remain fixed to the face of the tape. Moreover, if the tape made with this adhesive remains rolled up on itself for a few days it develops wrinkles which extend through the backing and destroy the desired appearance.

I have now discovered that a satisfactory pressure-sensitive adhesive tape can be made by combining a backing of plasticized gamma-polyvinyl chloride or other polymer in which the principal constituent is vinyl chloride with an adhesive comprising rubber, a resinous material, and polyisobutylene.

The backing sheet may be made by any of the usual methods—e. g., extrusion, molding, calendering, or by rotating a heated cylinder partly immersed in a solution of the desired polymer and plasticized in a volatile solvent, and stripping the resultant film from the cylinder as it rotates. The thickness of the backing sheet may vary over a wide range, depending upon the particular use to which the tape or sheeting is to be put. In general, thicknesses of .001 to .004 inch or more are satisfactory. Any of the usual plasticizers may be used with the polymer, but more than about 20% by weight of the plasticizer, based on the weight of the polymer, produces a sheet which is too soft to be useful. Plasticizers such as tricresyl phosphate, dibutyl phthalate, dioctyl phthalate, tributyl aconitate, butyl phthalyl butyl glycollate and the like all give satisfactory sheets. Any of the pigments or dyes commonly used in the rubber or plastics industries may be incorporated in the backing composition to provide a variety of effects. In order to increase the stability of the polymeric composition toward sunlight and ultraviolet light it may be desirable to add small amounts of stabilizers such as calcium stearate, calcium silicate, lead silicate, partial esters of polyhydric alcohol and unsaturated fatty acids, triethanolamine, and the like.

Although the rubber, polyisobutylene, and resinous material of the adhesive layer are all essential ingredients, their relative proportions may vary over a fairly wide range. In general, about 50 to 75% by weight of milled rubber, 15 to 30% of polyisobutylene, and 5 to 15% of resinous material are desirable. The rubber should be well milled or plasticated before using, and may be either natural or a synthetic such as a copolymer of butadiene with another copolymerizable monomer. The polyisobutylene should preferably be a material with a moderately long chain-length, although other materials are also satisfactory. Such compounds as the oily material sold as Vistac or the rubbery material sold as Vistanex are suitable. The resinous material is preferably an ester gum, although other materials such as melted rubber, rosin, or the like may be used. It is usually preferable to apply this adhesive to the backing in the form of a solution in a volatile solvent such as gasoline, hexane, benzene, or mixtures of these materials with each other or with other hydrocarbon liquids. The solution may be applied by spreading, spraying, or any other suitable method.

As a specific example of my invention I have prepared a backing containing 100 parts of gamma polyvinyl chloride, 5 parts of dioctyl phthalate, and 2 parts of the monoester of glycerine and cottonseed fatty acid. A polished metal drum heated to a temperature of about 150° C. is rotated through a 10% solution of this composi-

tion in cyclohexanone. The transparent film produced is about .002 inch thick and is stripped from the drum before the completion of its revolution. This film is then coated on one side by means of a spreading machine with a solution of 20 parts of milled rubber, 7 parts of the rubbery polyisobutylene sold as Vistanex and 3 parts of ester gum in 10 parts of benzene and 80 parts of gasoline. After drying at a temperature between 30° and 50° C. or more the product may be rolled up on itself and cut to tapes of the desired width.

Tape such as this has not only the desirable feature of transparency and glossy surface, but also is extremely resistant to deterioration from light, heat, oils, solvents, and many corrosive chemicals.

I claim:

1. A pressure-sensitive adhesive sheet comprising a backing consisting substantially of a plasticized polymer in which the principal constituent is vinyl chloride, and an adhesive layer consisting of rubber, polyisobutylene, and a member of the class consisting of melted rubber, rosin, and ester gum.

2. A pressure-sensitive adhesive sheet comprising a backing consisting substantially of a plasticized polymer in which the principal constituent is vinyl chloride, and an adhesive layer consisting of rubber, ester gum, and polyisobutylene.

3. A pressure-sensitive adhesive sheet comprising a backing consisting substantially of plasticized gamma-polyvinyl chloride and an adhesive layer consisting of rubber, ester gum, and polyisobutylene.

4. A pressure-sensitive adhesive sheet comprising a backing consisting substantially of plasticized gamma-polyvinyl chloride and an adhesive layer consisting of rubber, polyisobutylene, and a member of the class consisting of melted rubber, rosin, and ester gum.

5. A transparent pressure-sensitive adhesive sheet comprising a backing consisting substantially of plasticized gamma-polyvinyl chloride and an adhesive layer consisting of 20 parts of milled rubber, 7 parts of polyisobutylene, and 3 parts of ester gum.

RICHARD F. SCHMIDT.

Patented Oct. 29, 1946 2,410,089

UNITED STATES PATENT OFFICE

2,410,089

PRESSURE-SENSITIVE ADHESIVE TAPE

William E. Lundquist and Waldo Kellgren, St. Paul, Minn., assignors to Minnesota Mining & Manufacturing Company, St. Paul, Minn., a corporation of Delaware

No Drawing. Application August 17, 1944, Serial No. 549,963

8 Claims. (Cl. 117—122)

1

This invention relates to an improved pressure-sensitive adhesive sheet, conveniently in the form of an adhesive tape, having a flexible unified paper backing provided with a coating of eucohesive pressure-sensitive adhesive. By eucohesive is meant that the adhesive is more cohesive than adhesive, but still tacky.

Paper backings for pressure-sensitive adhesive tapes have previously been unified with impregnating compositions comprising broken-down rubber and rosin. Such compositions adhere well to paper fibers, are high in internal strength, are sufficiently compatible with lacquer solvents and the like so that lacquer deposited upon the back surface of the finished tape will be held thereon and will not run off onto the adjacent margin of the area being lacquered, and in general are such as to produce adequately unified and otherwise desirable paper backings for pressure-sensitive adhesive tapes.

However these prior art unified backings, being somewhat sensitive to lacquer solvents, do not possess a high degree of resistance to solvent penetration, or of "bleedproofness", i. e. resistance to the penetration through the backing of coloring material from colored lacquers. Furthermore the impregnation of the paper being usually carried out from hydrocarbon solvents adds to the expense of the operation and creates explosion hazards which require extra precautions and equipment.

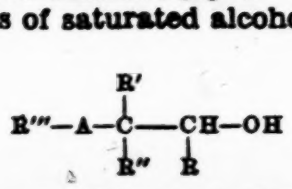
Paper backings for pressure-sensitive adhesive tapes have also previously been unified by impregnating with aqueous solutions of glue plasticized with glycerine. Such backings are for all practical purposes entirely resistant to penetration by lacquer solvents but possess the disadvantage of being sensitive to changes in humidity.

Vinyl acetate is a readily available low cost and hence highly desirable raw material which may be polymerized, either alone or together with other unsaturated and polymerizable materials, to form synthetic polymers. Polyvinyl acetate alone is a hard, tough solid which may be plasticized with various suitable liquid plasticizers to form soft masses which might be used for the unification of paper. But these compositions, due to the migration of the plasticizer from the vinyl acetate polymer, may cause softening and weakening of pressure-sensitive adhesive films in contact therewith, and hence are not satisfactory for use in unified paper backings for pressure-sensitive adhesive tape. Vinyl acetate has been copolymerized with methyl and ethyl esters of maleic and fumaric acids, but these copolymers

2

are even less flexible than unmodified polyvinyl acetate and are likewise unsuited for the unification of paper backings for pressure-sensitive adhesive tapes because of the necessity of plasticizing with liquid plasticizers.

We have now found that certain strong, flexible, adherent synthetic polymers prepared by the copolymerization of vinyl esters such as vinyl acetate with certain neutral esters of ethylene-alpha, beta-dicarboxylic acids may be utilized without addition of plasticizers or other deleterious compounding ingredients for the impregnation and unification of paper backings for pressure-sensitive adhesive tapes. These neutral esters are esters of saturated alcohols having the formula:



in which R, R′ and R″ are hydrogen atoms or saturated alkyl groups, A is oxygen, methylene, or an alkyl methylene group, and R‴ is a saturated alkyl or alkoxyalkyl group. Tertiary alcohols are not suitable for this work because their esters are too unstable when heated. Secondary alcohols, where R is an alkyl group, are of somewhat less interest than primary alcohols, where R is hydrogen. The alcohols used should be saturated, that is, they should contain no carbon to carbon double bonds, since ethylene-alpha, beta-dicarboxylic acid esters of unsaturated alcohols would give excessive amounts of cross-linking when copolymerized with the vinyl ester. Di- or polyhydric alcohol esters, being di- or polyfunctional would likewise give excessive amounts of cross-linking when copolymerized with the vinyl ester. However, small amounts of these or other cross-linking agents may be used in combination with the principal monomers, with advantageous results.

The neutral esters to be copolymerized with vinyl acetate are readily prepared by heating a mole of maleic acid or anhydride or of fumaric acid with an excess (more than 2 moles) of the alcohol or alcohols to be used, together with a small amount of acid catalyst, to a temperature above 100° C., and removing the water formed during the reaction by distillation. Para-toluene sulfonic acid is the preferred catalyst for this esterification and it is generally used in amounts ranging from ½–2% based on the maleic acid or anhydride or fumaric acid. In the case of alcohols which are immiscible with water, it is a very simple matter to distill

alcohol and water from the reaction mixture, separate the water and return the alcohol to the reaction vessel. In the case of 2-ethoxyethanol, the water formed during the esterification may be removed through a fractionating column. Benzene, toluene, heptane or other volatile, water-immiscible solvents may be added to the reaction mixture to aid in the removal of water if desired. In this way the reaction is readily carried to completion. The excess alcohol, and the volatile solvent if any is used, are removed by distillation and the product may be used for polymerization in this crude form, or it may be purified by washing with a dilute aqueous alkaline solution to remove the catalyst and any unesterified acid, or by distillation under reduced pressure.

In those esterifications starting with fumaric acid, esters of fumaric acid are obtained. When maleic acid or anhydride is used as the starting material the conditions of esterification generally cause some of the maleic acid products to isomerize into corresponding fumaric acid derivatives so that the final product obtained consists of a mixture of the two. It is believed, however, that the amount of fumaric acid ester present in the products prepared from maleic acid or anhydride is small, and accordingly in this specification esters prepared from maleic acid or anhydride are referred to as maleates. The maleate esters may be more completely converted into fumarate esters if desired by any of the common methods, such as by treatment with secondary amines, light, heat, acids, etc.

Commercial vinyl acetate which has been distilled to free it of inhibitor is suitable for these polymerizations. It should be free from excessive amounts of acetaldehyde since the presence of acetaldehyde tends to inhibit the polymerization and to lead to low molecular weight products.

The copolymerizaton of vinyl acetate with these maleic acid and fumaric acid esters is readily carried out by any of the common methods of polymerization. The method of most interest in the preparation of thees copolymers is the so-called emulsion method whereby these products are obtained in a dispersed form. These dispersions are of interest for use directly in the impregnation of paper since this eliminates organic solvents which would increase the cost of operation and introduce explosion hazards. By using such aqueous dispersions it is also possible to use copolymers so highly cross-linked as to be completely insoluble in organic solvents. These dispersions are usually prepared with a solids content of 30–60%.

Any of several commercial emulsifying agents may be used in the preparation of these dispersions, including long chain alkyl sulfate salts, alkyl substituted aryl sulfonic acid salts, soaps and salts of long chain amines. A small amount of a protective colloid may be added to stabilize the dispersion; methyl cellulose, gelatin, methyl starch, polyvinyl alcohol, sodium alginate, and the like may be used. Any of the various water soluble peroxide type catalysts, such as ammonium persulfate, potassium persulfate, hydrogen peroxide or sodium perborate may be used, usually in amounts of 0.1–2%, based on the monomers. The pH during polymerization is generally maintained between 4 and 7. The use of a pH appreciably higher than 7 is to be avoided since an excessive amount of vinyl acetate is hydrolyzed during the polymerization at elevated pH. The polymerizations are generally run at a

temperature of between 50° C. and the temperature at which the reaction mixture refluxes gently, although other temperatures may also be used. It is generally preferred to carry out the polymerization at the lowest temperature which will still give an economical rate of reaction since this gives higher molecular weight products. In general, it is possible to complete these polymerizations in from 1 to 6 hours, depending on the composition of the monomers, concentration, amount of catalyst and temperature employed.

By copolymerizing vinyl acetate and maleate or fumarate esters with small amounts of acrylic acid it is possible to prepare dispersions which are very stable to mechanical action and which have a very small particle size. Since acrylic acid is difficult to isolate in pure form it has been found convenient to hydrolyze methyl or ethyl acrylate with an equivalent amount of sodium hydroxide solution to give a sodium acrylate solution. Such a sodium acrylate solution does not polymerize and yields acrylic acid readily on acidification. In order to get the acrylic acid to copolymerize uniformly with the vinyl acetate and maleate or fumarate esters it is necessary to control the pH of the polymerization mixture. In general it is preferred to carry out the polymerization in the presence of these acrylates at a pH between 3.5 and 6. Other equivalent polymerizable carboxylic acids may be substituted for the acrylic acid.

These polymerizations may also be carried out by other known methods, for example the granular method, and the resulting polymers may be dispersed or dissolved in water or organic solvents for use in the impregnation of paper.

We have found that copolymers which have most desirable properties as impregnants and unifying agents for paper backings for pressure-sensitive adhesive tapes have a modulus of elasticity of between 4 and 15 megadynes per square centimeter, although copolymers having a modulus of as low as 2½ or as high as 25 megadynes per square centimeter may be used in some instances. At values lower than 2½ the polymer is too soft and the impregnated paper is not sufficiently unified; at values higher than 25 the polymer is too stiff and the impregnated and unified paper is harsh and brittle.

The modulus of elasticity as here referred to and as specified in the claims is calculated from the stress at 10% elongation as determined on a thin film of the copolymer tested at 25° C. in a Scott Inclined Plane Serigraph, or an equivalent testing apparatus, wherein the time required to obtain 10% elongation is in the range of approximately 1 to 4 seconds.

In many cases, it is desirable to add 0.1–3.0% of a polymerizable material containing two or more polymerizable groups per molecule to the reaction mixture to get a cross-linked copolymer. The use of such a cross-linking agent decreases the solubility of the resulting copolymer, decreases its tendency to stretch, (i. e. increases its modulus of elasticity), increases its strength and decreases its tendency to change in physical properties with change in temperature. Suitable cross-linking agents for use in this manner include the allyl, methallyl and crotyl esters of succinic, maleic, fumaric, adipic, sebacic, phthalic, acrylic, methacrylic, crotonic and cinnamic acids, glycol diacrylate and dimethacrylate, divinyl ether, tung oil and di- or polyfunctional esters made from maleic or fumaric acid with ethylene

glycol or other polyhydric alcohol and a monohydric alcohol, such as diamyl ethylene dimaleate.

If desired, small amounts of other vinyl and butadiene compounds may be included in these copolymerizations to modify the properties of the copolymers. Polymerizable compounds of interest in this connection include isoprene, butadiene, isobutylene, vinyl ethers, vinyl chloride, vinylidene chloride, acrylate and methacrylate esters, acrylonitrile, styrene and methyl vinyl ketone. The use of relatively small amounts of isoprene or butadiene in these copolymerizations is often desirable because the products obtained are vulcanizable.

By "unified paper backing" we mean that the paper is saturated with a material which binds or welds the fibers together so that the backing will not split or the fibers pull loose under the force exerted by the eucohesive pressure-sensitive adhesive coating when the adhesive tape product is unwound from rolls or removed from surfaces to which temporarily applied; that is, a fiber unity is present which prevents the unity of the backing from being destroyed by the pull of the adhesive.

The paper backing may be creped, crimped, embossed, molded or otherwise formed so as to provide rugosities or corrugations whereby stretchability and an interrupted contacting surface are secured in the adhesive sheet product to facilitate unwinding from rolls and removal from stacks or surfaces to which temporarily applied, and to facilitate conforming the adhesive sheet to curved or irregular outlines or surfaces to which it may be applied. For purposes of convenience all such paper will be referred to hereafter as "creped paper." A flat, uncreped paper may likewise be employed where stretchability is not needed or wanted.

Any type of paper or paper-like sheet may be used so long as it is sufficiently porous or bibulous to permit of adequate impregnation to result in the desired unification. It may be made in whole or in part from wood, rope or rag fibers, or from other fibrous material, natural or synthetic, adapted to the making of thin flexible sheet material of adequate porosity and tensile strength after impregnation. Fibrous glass sheets, for example, may be suitably unified with the copolymers of our invention.

The invention is not limited to true paper as the backing. Thus a fabric of carded cotton fibres can be used. Various felted fabrics can be employed. All of these are to be understood as embraced within the term "paper" as used in the claims, distinguishing from woven fabrics.

Impregnation of the porous paper sheet may be by any of the methods well known in the art, for example by knife or roll coating, use of squeeze rolls, dipping, or spraying. Where the paper when wet with water is so weak as to break off readily under tension, we prefer to apply a light preliminary treatment by means of mechanically driven squeeze rolls, followed by careful drying, so as to obtain sufficient wet strength for subsequent handling in a saturating tank or the like. Paper having an initial wet strength, such as may be provided by treatment in the beater with various known materials, may however be used where available; and such paper may be completely saturated in a single treatment as will be more fully described.

In general the paper is impregnated with a total amount of copolymer dry solids approximately equal to the dry weight of the paper, although higher or lower coating weights may be used with certain papers or for special purposes. With the dispersions of this invention it is possible to obtain uniform distribution of the solids within the sheet of paper, and not a mere deposition on the surface of the sheet. This results in a desirably high degree of unification. Before this saturation the paper will be very permeable to air, but after saturation the unified paper will have a greatly reduced permeability such that its porosity value, as hereinafter defined, is at least as high as 200 seconds.

In the following examples, all parts are given as parts by weight.

Example 1

In this example a heavy porous creped paper is impregnated and unified by means of a cross-linked copolymer of one part of vinyl acetate and two parts of 2-ethylbutyl maleate applied in aqueous dispersion. The unified backing is provided with a pressure-sensitive adhesive coating to yield a pressure-sensitive and satisfactorily unified adhesive tape.

The cross-linked copolymer is prepared as follows: 900 parts of water, 9 parts of Duponol ME (technical sodium lauryl sulfate, produced and sold by E. I. du Pont de Nemours & Co., Inc.), 8 parts of polyvinyl alcohol, 9 parts of sodium bicarbonate and 5 parts of ammonium persulfate are charged into a suitable kettle. The reaction mixture is heated with stirring to form a homogeneous solution at 120° F. Then a mixture of 350 parts of 2-ethylbutyl maleate, 115 parts of vinyl acetate and 10 parts of diamyl ethylene dimaleate is added to the reaction mixture. The diamyl ethylene dimaleate is readily prepared by reacting one mole of ethylene glycol with two moles of maleic anhydride and then completing the esterification with amyl alcohol added in excess, and in the presence of a suitable catalyst such as 1% of p-toluenesulfonic acid, followed by distillation to remove excess unreacted amyl alcohol.

The reaction mixture is heated to 150–155° F. to effect polymerization. After 1 hour at this temperature an additional 20 parts of vinyl acetate is added, with a second and third 20 part portion added after 1½ and 2 hours. After an additional hour at this temperature the reaction mixture is heated during a period of 1 hour to 175° F. and is held at this temperature for an additional hour. Thus the total reaction time is 5 hours. At the end of the reaction, 35 parts of 10% sodium bicarbonate solution is added to the reaction mixture. The non-volatile portion of the dispersion amounts to 35–36%. A dried film is found to be strong and flexible.

This dispersion is utilized in unifying a heavy crepe paper, e. g. "Walpole" crepe, produced by the Hollingsworth and Vose Co. of East Walpole, Mass.; an 85 lb. paper (weighing 85 pounds per ream of 480 sheets 24 x 36 inches) and having approximately 5 major crepe lines per lineal inch, an overall caliper of approximately .020 inch, a porosity of 7 seconds, and a lengthwise tensile strength of about 12.5 lbs. per ½ inch, is used. The porosity is determined on a Gurley Densometer, and indicates the numbers of second required for 400 c. c. of air to pass through a 1⅛ inch diameter single thickness of paper under the conditions provided by that instrument.

The paper is first passed through the dispersion to which has been added one-fifth of its

volume of water, and is then passed between squeeze rolls, so as to provide a wet coating weight of 38–40 grains of the dispersion per 24 square inches. The wet paper is then dried in an oven at 120–130° F.; during the first few minutes, the relative humidity in the oven is maintained at 50–75% to permit complete penetration of the dispersed copolymer into the sheet.

After complete drying, the partially treated paper is given a further impregnation with the undiluted dispersion, preferably by a combination of floating on, and dipping through, the dispersion, with the final coating weight again being controlled by means of squeeze rolls. The combination of floating, whereby the dispersion penetrates the sheet and forces out the entrapped air, and dipping, whereby both surfaces of the sheet are well covered with the dispersion, ensures the complete and uniform impregnation of the sheet with the dispersion. Such a method of impregnation is more fully described in U. S. Patent No. 2,227,444, issued January 7, 1941, to R. G. Drew. A wet coating weight of 21–24 grains per 24 square inches is thus obtained; after drying the sheet, it is found to contain a total of 20–25 grains of dry copolymer, and to have a porosity of at least 1000 seconds.

To secure efficient bonding of the pressure-sensitive adhesive to this unified backing, it is found desirable to prime the surface of the sheet. A suitable primer may be made as follows: 63 parts of zinc oxide is milled into 100 parts of light carcass reclaim (such as No. 34 Reclaim Rubber, from Philadelphia Rubber Works Co. of Akron, Ohio, which is a light carcass grey reclaim containing 62% rubber content and having a specific gravity of 1.20), using the customary roller mill employed in the milling of rubber. Separately, 195 parts of zinc resinate (such as "Pale Zitro" resin, a resinate containing 4.8% combined zinc, obtained from Newport Industries, Inc.) is blended with 49 parts of heavy paraffin oil by heating at 400° F. Three hundred twenty six parts of the milled base, 224 parts of the resin-oil blend, and 44.5 parts of pale gum rosin (such as "Nelio N" pale gum rosin from the Glidden Co.) are then mixed in a heavy duty internal mixer of the Werner-Pfleiderer type. A total of 22 parts of a 50% solution of potassium hydroxide, 33 parts of a 25% solution of casein in ammonia water, and 270 parts of water are added, according to known procedures, so as to produce a smooth, uniform dispersion of the rubber-resin-oil mixture in aqueous vehicle. A coating weight of the primer dispersion of 3–4 grains per 24 square inches is then applied by means of a roll coater to one surface of the unified backing, and is suitably dried, to provide an improved bond between the backing and the subsequently applied pressure-sensitive adhesive.

The same light carcass reclaim used in the preparation of the primer may also be used in making the adhesive. To 198.5 parts of the reclaim is first added, by milling, 1.5 parts of a suitable antioxidant (such as "Flectol H", a condensation product of acetone and amiline produced by the Rubber Service Laboratories Division of Monsanto Chemical Co.). Twelve hundred parts of this mill base is then dispersed, together with 142.5 parts of "Nelio N" rosin and 11.4 parts of heavy paraffin oil, in a mixture of 178 parts of ethyl alcohol and 1780 parts of heptane, to form a smooth fluid mass which is subsequently coated, as by means of a suitable knife coater, on the primed unified backing. Approximately 20–21 grains of the dry adhesive residue per 24 square inches is a satisfactory coating weight. Drying is conveniently accomplished by passing the coated sheet through an oven.

The final product may be slit into tape form and wound on its own backing in roll form. The rolls may then subsequently be unwound without danger of lamination or fuzzing of the treated paper backing. The tape is resistant to the action of moisture, organic solvents, and the like; and the adhesive is not softened nor weakened by prolonged contact with the backing.

Example 2

While the copolymer described under Example 1 may be used for the unification of various other papers, where lighter weight papers are to be treated for use in Masking tape and the like it is preferred to use the somewhat stronger copolymer hereinafter to be described. This polymer is made as follows:

Twenty four parts of Duponol ME, 14 parts of ammonium persulfate and 35 parts of a 28% sodium acrylate solution are dissolved in 2400 parts of water in a suitable reaction vessel. Seven hundred parts of vinyl acetate and 700 parts of 2-butoxyethyl maleate are added and the pH is adjusted to 5.4. The temperature of the agitated reaction mixture is then raised to 60° C. and is kept between 60 and 70° C. for six hours to complete the polymerization and is then cooled. The pH of about 5.3 is raised to 6.8 by the addition of approximately 150 parts of 10% aqueous sodium bicarbonate solution. The product contains 34% of non-volatile material.

A light weight porous crepe paper, such as "Duracel" crepe having a ream weight of 27 lbs. and a porosity of 3 seconds, is impregnated and unified with the copolymer thus obtained, by methods described under Example 1. In this case, the first treatment, using squeeze rolls, provides sufficient "wet strength" so that the partially treated paper is subsequently able to resist the tension of the machine during the floating and dipping operation without breaking or pulling apart. Where necessary, a further saturation of the sheet may be applied after the float and dip, in order to provide a final dry coating weight of copolymer approximately equal to the original dry weight of the paper, i. e. 10–11 grains per 24 sq. in.

The unified backing thus obtained is primed on both sides with a light coating of the primer described in Example 1. One side is then further coated with a light but essentially continuous coating of shellac, applied as a 35 percent solution in alcohol by means of coating rolls; the resulting dried film of shellac is found to be well bonded to the backing by virtue of the intercalated layer of primer, which also aids in preventing penetration of the shellac through the backing and to the face side where it might subsequently prevent adequate bonding of the pressure-sensitive adhesive to the backing.

The pressure-sensitive adhesive of Example 1 may also be used with the backing of the present example, being coated by means of a knife coater or other suitable means on the primed face side of the unified backing. After final drying, the product may be slit and wound into rolls, and makes a highly satisfactory pressure-sensitive adhesive masking tape.

In the above construction, the shellac coating provides a surface to which the adhesive coating does not readily adhere, and therefore permits easy unwinding of the tape from rolls.

However, where the tape is used in multiple layers, as in masking, the shellac provides sufficient anchorage for the adhesive of the next tape layer so that the tape is enabled to remain in position under such light stresses as are occasioned by the action of a lacquer spray gun. Adhesion of the particular adhesive herein described to the original unified backing of this example prior to priming and shellacking is sometimes so light as to cause trouble with the tape lifting or blowing off under these conditions.

The tape of this example is not affected by changes in atmospheric humidity, and is resistant to the solvent and softening action of the usual lacquer solvents. The adhesive retains its full strength even on long contact with the backing.

Example 3

The copolymer of this example is prepared from equal parts of vinyl acetate and 2-ethoxyethyl maleate, with a small proportion of cross-linking agent. It is prepared in aqueous dispersion as follows:

In a reaction vessel equipped with a mechanical stirrer, a thermometer and a condenser, 16 parts of Duponol ME, 12 parts of ammonium persulfate and 45 parts of 28% sodium acrylate solution are dissolved in 1650 parts of water. Nine hundred parts of vinyl acetate, 900 parts of 2-ethoxyethyl maleate and 36 parts of diamyl ethylene dimaleate are added and the pH of the reaction mixture is adjusted to 4.0. The reaction mixture is heated to 65° C., is held at 65 and 70° C. for five hours to effect polymerization and is then cooled. The mixture, which at this point has a pH of 4.6 is raised to a pH of 6.3 by the addition of approximately 150 parts of 10% aqueous sodium bicarbonate solution. The product contains 48% of non-volatile material.

This dispersion is well suited for impregnation of bibulous paper because of its high degree of stability to mechanical action, its small particle size and its high solids content. For example a 27 pound bibulous crepe paper, containing 1% by weight of a melamine-formaldehyde resin to give the paper a high wet strength, may be readily unified and given a high porosity value by saturating with this dispersion in a single "float and dip" operation and then drying.

Such treated paper may be readily converted into tape by applying a shellac backsize from alcohol solution, heating at 125° C. for one hour to improve the unification of the backsized backing and then applying a reclaim adhesive, such as the adhesive of the previous example, to the face side. The finished tape may be slit and wound into rolls.

This tape is superior to previously prepared tapes in being resistant to both water and organic lacquer solvents.

Example 4

Vinyl esters other than vinyl acetate may also be used for the preparation of suitable copolymers for impregnating paper to obtain pressure-sensitive adhesive tape backings. In this example a copolymer of vinyl propionate and n-butyl maleate is used.

Two and one-half parts of Duponol ME, 1 part of ammonium persulfate and 5 parts of a 28% sodium acrylate solution are dissolved in 250 parts of water in a suitable reaction vessel. Seventy five parts of vinyl propionate and 25 parts of n-butyl maleate are added and the pH is adjusted to 5.2. Polymerization is effected by heating with stirring to 80–90° C. for four hours. The final pH is raised to 6.8 by the addition of aqueous 10% sodium bicarbonate solution. The resulting dispersion contains about 30% solids.

This dispersion may be used to saturate and unify porous creped paper which in turn may be made into rolls of tape as in Example 2. Such tape possesses very good strength and is superior to previously prepared tapes in being resistant to both water and to lacquer solvents.

While the specific examples given above show only one type of pressure-sensitive eucohesive adhesive, it is to be understood that other adhesives having similar properties may be substituted therefor. Thus, adhesives having a polyisobutylene base, or a base of crude or of synthetic rubber, synthetic resin may be substituted. Similar substitutions may also be made in regard to primers.

Where backsizing materials are required, materials other than shellac or the like may frequently be used to advantage; thus ethyl cellulose applied from solution in a suitable organic solvent may be used.

Having described various embodiments of our invention, for purposes of illustration rather than limitation, what we claim is as follows:

1. A pressure-sensitive adhesive tape having a unified paper backing member comprising a flexible porous paper impregnated and unified by a relatively non-tacky, non-hygroscopic copolymer of vinyl acetate and a neutral ester of an ethylene-alpha, beta-dicarboxylic acid in which at least about half of the carboxylic acid groups are esterified with a saturated beta-alkoxyethanol, said copolymer having a modulus of elasticity between 2½ and 25 megadynes per square centimeter.

2. A pressure-sensitive adhesive tape having a unified paper backing member comprising a flexible porous paper impregnated and unified by a relatively non-tacky, non-hygroscopic copolymer of a vinyl ester and a neutral ester of an ethylene-alpha, beta-dicarboxylic acid having a modulus of elasticity between 2½ and 25 megadynes per square centimeter.

3. A pressure-sensitive adhesive tape having a unified paper backing member comprising a flexible porous paper impregnated and unified by a relatively non-tacky, non-hygroscopic copolymer of a vinyl ester and a neutral ester of an ethylene-alpha, beta-dicarboxylic acid having a modulus of elasticity between 4 and 15 megadynes per square centimeter.

4. A pressure-sensitive adhesive tape having a unified paper backing member comprising a flexible porous paper impregnated and unified by a relatively non-tacky, non-hygroscopic copolymer of a vinyl ester and a neutral ester of an ethylene-alpha, beta-dicarboxylic acid in which at least about half of the carboxylic acid groups are esterified with a saturated beta-alkoxyethanol, said copolymer having a modulus of elasticity between 2½ and 25 megadynes per square centimeter.

5. A pressure-sensitive adhesive tape having a unified paper backing member comprising a flexible porous paper impregnated and unified by a relatively non-tacky, non-hygroscopic copolymer of vinyl acetate and the di-betaalkoxyethyl ester of an ethylene-alpha, beta-dicarboxylic acid having the formula HOOC—CH=CH—COOH, said copolymer having a modulus of elasticity between 2½ and 25 megadynes per square centimeter.

6. A pressure-sensitive adhesive tape having a

unified paper backing member comprising a flexible porous paper impregnated and unified by a relatively non-tacky, non-hygroscopic copolymer of vinyl acetate and 2-butoxyethyl maleate, said copolymer having a modulus of elasticity between 2½ and 25 megadynes per square centimeter.

7. A pressure-sensitive adhesive tape having a unified paper backing member comprising a flexible porous paper impregnated and unified by a relatively non-tacky, non-hygroscopic copolymer of vinyl acetate and 2-butoxyethyl maleate in approximately equal parts by weight, said copolymer having a modulus of elasticity between 2½ and 25 megadynes per square centimeter.

8. A pressure-sensitive adhesive tape having a backing member comprising a flexible porous paper impregnated and unified with an approximately equal weight of a copolymer of monomers comprising (*a*) a neutral vinyl ester and (*b*) a neutral ester of an ethylene-alpha, beta-dicarboxylic acid, said copolymer having a modulus of elasticity of between 2½ and 25 megadynes per square centimeter.

WILLIAM E. LUNDQUIST.
WALDO KELLGREN.

Patented Sept. 13, 1949 2,481,896

UNITED STATES PATENT OFFICE

2,481,896

PRESSURE SENSITIVE ADHESIVE TAPES

Paul F. Ziegler, Winnetka, Ill., assignor to The Kendall Company, Boston, Mass., a corporation of Massachusetts

No Drawing. Application December 10, 1943, Serial No. 513,711

5 Claims. (Cl. 117—122)

1

This invention relates to pressure-sensitive adhesive tapes, and more particularly to the preparation of such tapes wherein the adhesive thereof comprises a polyvinyl pressure-sensitive adhesive, and wherein the backing may be a transparent, non-fibrous sheet material such as regenerated cellulose.

An accepted backing material for transparent pressure-sensitive adhesive tapes is regenerated cellulose. Because of its smooth, non-fibrous, glossy surface, commercially satisfactory regenerated cellulose adhesive tapes have included a priming coat for the purpose of improving the bond between the pressure-sensitive adhesive and the backing by creating a preferential affinity of the adhesive for the surface of the primed backing to which it is applied, compared with its affinity for the surface of the backing without the interposition of the priming coat, and thus permit, after the tape has been wound upon itself in roll form, successful unrolling thereof without destructive separation or delamination of the adhesive from the backing. Rubber-resin adhesives generally used as pressure-sensitive adhesives in such tapes do not have commercially sufficient adhesion, when applied directly to the smooth glossy surface of regenerated cellulose in the absence of a priming coat or of some special technique of application, to permit such satisfactory unrolling.

This application is concerned with the preparation of non-rubber polyvinyl resin pressure-sensitive adhesives which may be directly affixed as firmly adherent coatings to regenerated cellulose or other similar smooth-surfaced transparent sheet backings and is a continuation-in-part of my application Serial No. 349,973, filed August 2, 1940, now Patent No. 2,426,257.

The foregoing application discloses inter alia the preparation of pressure-sensitive adhesives formed of a polyvinyl ester, a resin compatible with the polyvinyl ester, and a non-volatile liquid plasticizer compatible with both the polyvinyl ester and the resin; and wherein the polyvinyl ester serves as the film-forming vehicle for the adhesive and is present in sufficient proportion to impart structural supporting characteristics which permit the formation of a relatively thin continuous cohesive flexible coating thereof on a flexible sheet backing, inclusive of regenerated cellulose, to form a pressure-sensitive adhesive tape.

In so far as tapes having regenerated cellulose backings are concerned, such an adhesive has been found to have a remarkable affinity for the

2

regenerated cellulose surface to which it has been applied when the adhesive is prepared in accordance with the following formula:

	Parts
Vinyl co-polymer VYHH	30
Nevillac resin	30
Santicizer B16 (butyl phthalyl butyl glycollate	42

The vinyl co-polymer is a standard polyvinyl resin of the acetate-chloride type and in the form which has been used for the adhesives hereof has a chloride content of about 87% and a molecular weight of about 9,500–10,500. It is a product of Carbide & Carbon Chemicals Corporation. It constitutes the film-forming vehicle and is responsible for the elastic and cohesive characteristics of the adhesive.

The Nevillac resin is a phenol-modified coumarone-indene resin, a product of Neville Company, and is used in the above formula, has a melting point in about the range of 85 to 95° C. It forms the adhesive constituent of the adhesive.

Santicizer B16 is one of the Monsanto Chemical Company's non-volatile liquid plasticizers which are alkyl phthalyl alkyl glycollates. This particular Santicizer B16 is butyl phthalyl butyl glycollate. It activates the Nevillac resin to stickiness and renders the adhesive coating as a whole flexible.

These three ingredients may be added to a common organic solvent, such as ethyl acetate or acetone, in the order of plasticizer, co-polymer and Nevillac. The solvent can then be driven off as necessary to a point where the solids content is suitable for spreading as by a doctor blade or roll on regenerated cellulose sheet material—for example to about 50 to 80%, preferably 75%. Both the mixing and spreading may be accomplished at room temperature, but artificial drying may be helpful in driving off the solvents after the solution is spread upon the backing. It has been found that the tack of the coating improves as the thickness increases from .002" to .005". Hence the thicker coat is desirable.

A regenerated cellulose sheet, thus directly coated with my transparent adhesive in a one-coat operation without any interposed primer coat, may be slit and rolled and will meet the commercial requirements for a transparent cellophane pressure-sensitive adhesive tape. The roll may be unwound without delamination of the adhesive onto the backing even in the absence of separate interliners, and the tape can, like the usual cellophane tapes, be re-used. The adhe-

sive, which is clear and transparent, ages well and has good adhesion to metal, wood, paper and other materials to which cellophane tapes are now generally applied. The adhesion to skin is, however, not as aggressive as that of rubber-resin pressure-sensitive adhesives. This particular quality has been found to be a decided advantage because the tape is thus less sticky and less annoying to handle.

The proportions and ingredients so far recited represent the best formula with Hard Nevillac resin (i. e. 85–95° C. melting point) for general regenerated cellulose use. It should be noted that the film-forming ingredient and adhesive resin constituent are in a 1 to 1 ratio. Variation of this ratio is permissible, but experience shows that variation has resulted in sacrifice in quality, particularly with regard to the affinity for the regenerated cellulose. A decrease in vinyl polymer content, so that the ratio is 20–40–42, instead of 30–30–42, will result in a decrease in the adhesion and cohesion characteristics, but will increase the tack. On the other hand, if the plasticizer content be independently varied within the limits of from 90 to 50% of the combined vinyl polymer-resin base, the adhesion and cohesion will increase with decrease of plasticizer content, but the tack will decrease. In our experience, the 1 to 1 ratio provides the most desirable qualities of adhesion and cohesion for the purposes of a regenerated cellulose tape, and the tack can be kept suitably high with this ratio by the use of a higher proportion, e. g., 70% of plasticizer, aided, if desired, by a coating thickness of about .005". In any event, the film-forming vehicle content must be sufficiently high to give adequate cohesive strength to the adhesive coat, and, in accordance with this invention, must exceed 12% of the total content.

Equally successful results have been secured with the use of softer Nevillac resins, which range down to a melting point of about 65° C. These softer resins are also phenol modified coumarone-indene resins. Use of such softer resin permits a reduction in the plasticizer content, and, from the standpoint of cost and lighter color, an adhesive having the following formula is even more desirable than one following the Hard Nevillac formula:

	Parts
Vinyl co-polymer VYHH	30
Soft Nevillac resin	30
Santicizer B16 (butyl phthalyl butyl glycollate)	36

It will be noted that here the plasticizer content is in the ratio of .6 to the combined vinyl co-polymer and Nevillac content. Generally this plasticizer ratio may be .1 part less (figured on the combined co-polymer resin content) than in the case of the Hard Nevillac formula where, as above given, the ratio is .7. However, additional plasticizer variation will produce corresponding variation in tack, adhesion and cohesion results, generally corresponding to those heretofore discussed in the case of the Hard Nevillac.

In tapes constructed in accordance with this invention the adhesion of the tape mass to other regenerated cellulose surfaces may be in the range of from 0.6 to 1.2 or more pounds and the mass coating exhibits substantially the same degree of adhesion to its regenerated cellulose backing as it does to an external regenerated cellulose surface.

For the purposes of determining "adhesion" to external surfaces, as referred to in the preceding paragraph, a one-inch wide strip of convenient length of the tape to be tested is placed tacky surface down upon a smooth surfaced Bakelite panel under temperature conditions of 70° F. The panel is then placed at a 15° inclined position and a seven-pound roller which is free to move vertically is passed over the strip at the rate of one foot per minute up and back to adhere the pressure-sensitive surface to the panel. One end of the strip is then attached to the clamp of a tensile strength Scott tester and the average number of pounds required to pull a substantial length of the tape off the Bakelite surface at an approximate 180° angle and at a rate of one foot per minute is determined.

For the purposes of determining adhesion of a coating to its own backing, a double-face adhesive strip is interposed between the Bakelite panel and the strip to be tested. Such a double-face adhesive tape may be an ordinary surgical tape coated on both sides. The regenerated cellulose tape to be tested is then separated at one end of the tape from the adhesive mass and the clamp of the tester is affixed to this backing alone, the tester stripping the regenerated cellulose backing from its own mass which remains adherent to the double-face tape.

In addition to adhesion characteristics of the above type, it has been found that the mass film has extensive stretchability and a tensile strength in a one-inch width of about ¾ pound at 70° F. These latter characteristics, taken in connection with the adhesion characteristics, are factors contributing to the production of a tape which does not delaminate upon unrolling.

Cohesion of the above referred to masses are shown to be such that they have a "creep" characteristic exceeding 20 minutes as determined by placing a one-inch strip of the tape of several inches length, tacky side down, over a horizontally disposed, raised, one-inch diameter Bakelite cylinder, and suspending a one-pound weight from each end of the tape. The apparatus is then placed in an oven at 105° F. for a period of 15 minutes, after which time the tape is slashed across the top of the cylinder and the time required for either portion of the tape to fall from the cylinder is an arbitrary value assigned to the tape as its "creep" value. Some tapes of this invention reach a creep value exceeding 100 minutes.

A further determinative characteristic of adhesive tapes is that of aging. Tapes of this invention have successfully withstood a standard accelerated aging test comprising storage of the tape under 300 lbs. oxygen pressure at 105° F. for a period of one week. After such storage the tapes are still tacky and having adhesion values, determined in accordance with the previously given test, in excess of 0.6 lb., they can still be unrolled without delamination and instances of similar behavior have occurred even when the period in the oxygen bomb is as much as 3 weeks.

A further desirable feature is found in these tapes in that they exhibit a definite stability over a range of temperature and can be unwound without any detrimental delamination of the adhesive at any temperature in ranges as wide as from 40 to 160° F.

The Monsanto Chemical Company produces "Santolite" resins which may be successfully used instead of Nevillac resins. These Santolite resins are aryl sulphonamide-formaldehyde resins. Santolite MHP, preferred because of its

light color, has a melting point of about 65° C. and therefore its action is more similar to that of the soft Nevillac resin and should be used in the proportion of the soft Nevillac resin. Santolite MS, being a still softer resin (melting point 50° C.) detracts somewhat from the cohesion and requires a still further reduction in plasticizer with the plasticizer content, in some cases, being as low as 30% of the combined co-polymer resin content. However, it is contemplated that adhesives of this invention may be applied to suitable backings by a calendering operation rather than by a solvent spread as hereinbefore described. Thus the ingredients may be mixed and brought to the proper consistency for spreading by transferring the mix to a hot rubber mill to dissolve the solvent; or in some cases of relatively high resin-plasticizer content (for instance, 2 parts of co-polymer to 3 parts of resin and 3 parts of plasticizer), the co-polymer may be dissolved directly in a hot (140–150° C.) mixture of the resin and plasticizer and calendered at that or a lower temperature.

With regard to the film-forming vehicle, the superior results accomplished on cellophane with the co-polymer have not been attained with other polyvinyl esters, although polyvinyl acetate will be found acceptable especially when a smooth-surfaced backing is not contemplated or when priming coats are permissible. In general, polyvinyl acetate has softer characteristics than that of the co-polymer and therefore imparts less cohesive strength to an adhesive, while polyvinyl chloride has limited solubilities, a characteristic which renders solvent operations difficult.

In the case of polyvinyl acetate, pure phenolic resins (Beckacite) may be satisfactorily used as well as Nevillac. The Beckacite resins are not compatible with the co-polymer.

As to the plasticizer, modifications can be made so long as compatibility in the proportions used is observed. Other satisfactory plasticizers for the Nevillac-co-polymer mix, though not preferred, are other non-volatile liquid esters of phthalic acid, including either the dialkyl phthalates — dibutyl phthalate and dicapryl phthalate—or other mixed esters of phthalic acid and alcohols or hydroxy acids, dibutyl sebacate and mixed aryl sulfonamides, such as Santicizer 8 (Monsanto Chemical Co.). Either dibutyl phthalate or Santicizer B16 are compatible with polyvinyl acetate-phenolic resin mixes.

Adhesives may be suitably formulated in accordance with this invention for application to other sheet backings, either of the non-fibrous or fibrous variety, including woven or unwoven fibrous backings and smooth surfaced backings of the type of cellulose acetate, ethyl cellulose, polyvinyl ether, rubber hydrochloride or polyamides such as sheet nylon.

I claim:

1. A pressure-sensitive adhesive tape, comprising a flexible smooth-surfaced non-fibrous sheet backing material having affixed directly thereto on one side a firmly adherent coating of a normally tacky pressure-sensitive adhesive, whereby said tape may be rolled upon itself and unrolled without destructive delamination of the tape, said adhesive consisting essentially of a polyvinyl acetate-chloride co-polymer film-forming vehicle and a compatible normally solid meltable phenol modified coumarone-indene resin in about equal proportions, and a non-volatile liquid alkyl phthalyl alkyl glycollate plasticizer compatible with both said co-polymer and said resin in the proportion of about 30–90% of the combined weight of said co-polymer and resin.

2. A pressure-sensitive adhesive tape comprising a flexible smooth-surfaced non-fibrous sheet backing material having affixed directly thereto on one side a firmly adherent coating of a normally tacky pressure-sensitive adhesive, whereby said tape may be rolled upon itself and unrolled without destructive delamination of the tape, said adhesive consisting essentially of a polyvinyl acetate-chloride co-polymer film-forming vehicle and a compatible normally solid phenol modified coumarone-indene resin, said co-polymer and said resin being in about equal proportions, and a non-volatile liquid plasticizer compatible with both said co-polymer and said resin in the proportion of about 30–90% of the combined co-polymer resin weight.

3. A pressure-sensitive adhesive tape comprising a flexible smooth-surfaced non-fibrous sheet backing material having affixed directly thereto on one side a coating of a normally tacky pressure-sensitive adhesive, said adhesive being formed of a polyvinyl acetate-chloride co-polymer film-forming vehicle, phenol modified coumarone-indene resin and a non-volatile liquid plasticizer compatible with both said polymer and said resin, the proportion of ingredients being about 20–30 parts of co-polymer, about 30–40 parts resin and about 36–42 parts plasticizer.

4. A pressure-sensitive adhesive tape as claimed in claim 3 wherein the plasticizer is an alkyl phthalyl alkyl glycollate.

5. A pressure-sensitive adhesive tape as claimed in claim 3 wherein the plasticizer is butyl phthalyl butyl glycollate.

PAUL F. ZIEGLER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,115,584	Kittredge	Apr. 26, 1938
2,121,028	Gardner	June 21, 1938
2,147,772	Kallander	Feb. 21, 1939
2,179,339	Little	Nov. 7, 1939
2,192,314	Izard	Mar. 5, 1940
2,247,154	Geiger et al.	Jan. 24, 1941
2,319,933	Kerr	May 25, 1943

Reissued June 29, 1954 Re. 23,843

UNITED STATES PATENT OFFICE

23,843

INSULATING TAPE

Ralph J. Oace, New Canada Township, Ramsey County, Robert Burns Snell, Birchwood, and Esther E. Le Page, West Lakeland Township, Washington County, Minn., assignors to Minnesota Mining & Manufacturing Company, St. Paul, Minn., a corporation of Delaware

No Drawing. Original No. 2,559,990, dated July 10, 1951, Serial No. 641,000, January 12, 1946. Application for reissue July 9, 1952, Serial No. 298,013

9 Claims. (Cl. 206—59)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

1

This invention relates to the insulation and protection of electrical conductors, and to insulating tape employed therein.

Synthetic polymeric materials have recently replaced rubber and guttapercha to a great extent in the insulation of wires and cables, particularly those exposed to outdoor conditions or to oils or solvents. Materials such as polyvinyl chloride and polymers of ethylene, for example, have been applied by extrusion methods to copper wires to provide insulated conductors having excellent electrical characteristics as well as good chemical and mechanical properties. Such insulated wire has been widely accepted as an improved product.

The advantages of such insulation are not fully realized, however, when splices between lengths of the wire must be covered with previously known classes of insulation. The commonly used unvulcanized rubber base electrician's tape, for example, is not resistant to oils or sunlight, and does not adhere well to the synthetic polymer insulation. The tape is also low in mechanical strength, and a bulky outer wrapping of friction tape is ordinarily required to provide compression and mechanical protection.

As an alternative to the use of rubber insulating tape, strips of polymer of the same formula as that on the insulated wire have sometimes been used. In such an application, heating and molding are necessary in order to weld the polymer together into an integral insulating layer. The process is inconvenient and time-consuming, and requires special apparatus.

The present invention provides, for the first time, means for permanently covering, insulating, and mechanically protecting splices in polymer-covered wires as just described, by simple hand application of a single strip of stable, stretchable, retractable, pressure-sensitive adhesive tape. Our novel tape also has many additional uses, as hereinafter suggested.

Attempts have previously been made to provide similar strips, or films, of polymer with adhesive coatings so as to avoid the necessity of the subsequent heating and molding operations in covering and insulating wire splices. For example, polyvinyl chloride plasticized with not more than 20 parts of the usual plasticizer such as tricresyl phosphate or dioctyl phthalate has been sheeted out in roll form in thicknesses up to 4 mils or greater, and coated with a specific pressure-sensitive adhesive consisting of rubber, polyisobutylene, and a resinous material, in an attempt to produce a transparent flexible adhesive tape or sheet. With this amount of plasticizer, however, the sheet is found to be quite stiff and rigid. Very high stress is required to obtain any appreciable elongation; for example, a strip one inch in width and .004 inch in thickness of a mixture of 100 parts of an 89:11 vinyl chloride-vinyl acetate copolymer and 20 parts of dioctyl phthalate required a stress of 30 lbs. to produce even as little as 10% elongation. Increased elongation results in a whitening of the film, and the stretched film will then no longer retract to its original length at room temperature. Films, or coated adhesive tapes, having these properties cannot readily be applied by hand to wire splices or the like. While thinner films of similar composition might conceivably be used because of their reduced strength per unit of width, the low elasticity still precludes the acceptance of such tapes for applications such as the covering of wire splices. In addition, thicknesses of at least about four mils, and even up to twelve mils or somewhat higher, are generally preferred by electricians because of the reduced number of turns required for adequate insulation, as well as the absence of the flimsiness characteristic of thinner films.

2

Films have also been prepared with increased amounts of dioctyl phthalate or the like in an attempt to reduce the stress requirements and improve the elasticity. Thus, a composition consisting of 100 parts of a vinyl chloride polymer and 33 parts of dioctyl phthalate was calendered to a thickness of four mils and coated with a pressure-sensitive adhesive as hereinabove described. While the physical properties of the film were much improved, it was found that this particular adhesive as well as various other pressure-sensitive adhesives rapidly became soft and "pasty" when in contact with this or other vinyl polymer films containing more than about 20 parts of liquid type plasticizers. The resulting tape, when wound under tension around a splice or bundle of wires, soon loosened and became ineffective. This tendency was increased with even slight increase in temperature above normal room temperature.

The present invention avoids these and other defects of previously known insulating and binding materials of the type described, and provides, among other things, an improved insulated spliced electrical conductor which is electrically, mechanically and chemically effective, and which may be readily and quickly prepared without the use of special procedures or equipment. These unique and valuable results are obtained

by utilizing an insulating tape in the form of a relatively thick but easily stretchable and highly elastic pressure-sensitive adhesive tape comprising a well-bonded, water-insoluble, non-corrosive, normally tacky and pressure-sensitive adhesive coating on a plasticized vinyl chloride polymer film which is in permanent equilibrium with the adhesive. By "permanent equilibrium" it is meant that the pressure-sensitive adhesive layer neither softens (becomes "pasty") nor loses tackiness (becomes non-adherent) on prolonged contact with the backing or film layer. The adhesive remains aggressively tacky, and also remains "eucohesive" (by which it is meant that it is more cohesive than adhesive such that offsetting or transfer of adhesive material does not result when the tape is unwound from rolls or removed from surfaces to which temporarily applied and can be handled without transfer of adhesive material to the fingers).

In order to secure permanent equilibrium between backing and adhesive, we employ with the vinyl chloride polymer a combination of modifiers including a substantial but minor amount (not to exceed about 20 parts per 100 parts of the vinyl polymer) of a low molecular weight liquid plasticizer such as dioctyl phthalate, together with a substantially equal or somewhat greater amount of a high molecular weight resinous type plasticizer, the amount of the latter in any event being sufficient, together with the liquid plasticizer, to provide the desired degree of stretch in the final film. "Paraplex G–25" is a preferred example of a suitable resinous type plasticizer. It is sold by Resinous Products & Chemicals Corp., and is a soft, viscous alkyd resin having a specific gravity of 1.06, and an acid number of not more than 2.0; it is soluble in esters, ketones, aromatic and chlorinated hydrocarbons. Another high-molecular-weight plasticizer material which has been found useful in providing suitably stretchable and elastic vinyl polymer films is polymerized ethyl acrylate. Another example is polymerized vinyl butyl ether.

While resinous or high molecular weight modifiers such as "Paraplex G–25" are themselves capable of producing the desired degree of strength, stretch and elasticity in vinyl chloride polymer films, and furthermore are generally classed as "non-migrating" or "permanent" type modifiers or plasticisers, it is surprisingly found that these materials do not provide for permanent equilibrium of adhesive and backing as herein defined. Instead, it has been shown that pressure-sensitive adhesives in prolonged contact with highly stretchable and elastic films consisting solely of vinyl polymer and resinous modifier lose a great deal, if not all, of their initial tackiness or pressure-sensitivity. When tape made in this way is unwound from roll form, after a moderate period of storage, and applied to a splice, it does not adhere either to the electrical conductor or to its own backing, and hence is of no value as an insulating and protective coating.

The present invention provides an electrical insulating tape having properties of stretch and elasticity which render it highly effective for wrapping wire and cable splices. The tape is stretchable to the extent of at least about 50% at room temperature as measured in a tensile tester (such as a Serigraph Model I–P–4, manufactured by the Henry L. Scott Co. of Providence, R. I.). The tape can be readily stretched to this extent by pulling between the hands. In fact, the invention provides tapes which are

stretchable to the extent of at least about 100%, which is preferred. The elasticity of the tape is a valuable feature in making possible snug wrappings and coverings. The present tape is highly elastic as shown by the fact that when a strip is elongated 30% at room temperature and then released it will retract at room temperature to substantially the original length. The invention provides tapes that will substantially completely retract when elongated as much as 50% or even more. The method employed for making such retraction tests of elasticity is as follows. A number of tape lengths are cut. Each length is suspended from an upper clamp and is provided with a light clamp (weighing about 10 grams) at the lower end to provide means for applying a weight. Each tape strip is 1 inch wide and 5 inches long between clamps. Weights of various amounts are applied to the different samples to determine what weight is needed to produce the desired elongation (30%, for example) in 15 seconds. In the case of this sample, the weight is promptly removed at the end of the 15 seconds, and the length of the tape between clamps is measured at different time intervals to determine the retraction. The weight of the lower clamp is relatively so minute that it does not affect the result.

The preferred thickness of the backing film for the electrical tape is 4 to 20 mils. A thickness of about 5 to 10 mils is generally most useful.

The values of caliper, stretchability, flexibility, elasticity, adhesion, electrical properties, chemical stability or inertness, solubility, and other properties of the insulating tapes are designed and selected for greatest utility in the wrapping and protecting of splices in synthetic polymer insulated copper wire, as previously indicated. Some or all of these properties render the product useful for other purposes. For example, the adhesive tape may be used to bind together a number of insulated electrical conductors into a permanently compact, flexible, oil-resistant bundle or harness, by spirally winding such a bundle with a single overlapping strip of the tape applied under considerable tension. A similar spiral winding on metal racks employed in electroplating operations provides a chemically resistant coating which remains firmly attached to the rack during immersion in the plating bath. Single thicknesses of the tape are useful as abrasion or wear-resistant adherent surface coatings on flat or curved surfaces.

The following examples of insulating tapes in the form of pressure-sensitive adhesive tapes having a vinyl polymer film base were prepared with a vinyl chloride-vinyl acetate copolymer softening at about 280° F. and in which the ratio of vinyl chloride to vinyl acetate was approximately 89:11. The commercially available "Vinylite VYNS," sold by Carbide and Carbon Chemical Corp., is a suitable copolymer corresponding to this description. Other equivalent materials include copolymers having other vinyl chloride-vinyl acetate monomer ratios, such as 95:5. Polyvinyl chloride itself is satisfactory in many formulations, as are many of the copolymers of vinyl chloride and vinylidene chloride, of which one example is "Geon 200–X–6," a vinyl chloride-vinylidene chloride copolymer having a softening temperature of about 260° F., sold by B. F. Goodrich Co. Polymers softening at 300° F. or higher are ordinarily to be preferred where extremely high heat resistance solvent resistance, and the like are essential.

Many liquid plasticizers other than the dioctyl phthalate of the various examples may be substituted therefor. The plasticizer must be compatible with the vinyl polymer, and must be sufficiently low in volatility so that it is not driven off during milling and calendering, or during subsequent storage and use. Tricresyl phosphate, dibutyl phthalates, and butyl phthalyl butyl glycollate, for example, appear to be equally effective in most of the compositions herein described. All of these compounds are capable of producing pastiness in water-insoluble pressure-sensitive adhesives coated on vinyl backings when used in proportions greater than about 20 parts per 100 parts of the vinyl polymer.

Likewise, various compatible non-migrating resinous or high molecular weight modifying materials having a plasticizing effect on the vinyl polymer employed may be substituted in whole or in part for the specific alkyd resin hereinbefore mentioned. Ethyl acrylate polymer has been found useful, as previously noted; this modifier has somewhat less tendency to cause tack loss than does the "Paraplex G–25," hence may be used in even greater amounts in many formulations. A resinous material having properties essentially equivalent to Paraplex G–25 for our purposes has been prepared by heating together sebacic acid, propylene glycol, and ethylene glycol in a 10:9:1 molar ratio to a low acid number.

It will be understood that, where specific ratios of specific polymers, low molecular weight plasticizers, and high molecular weight plasticizers are described in the examples, substitution of equivalent but somewhat different materials may require alteration of these ratios in order to obtain equivalent results, all in conformity with well-recognized principles.

Various modifying agents which impart specific properties to the film may be added if desired. For example, a small amount of calcium stearate added prior to milling and calendering acts as a stabilizer in preventing darkening of the vinyl polymer or of the film. Other examples are lead silicate, calcium silicate, and triethanolamine.

In general, the tape products herein described are most conveniently and economically prepared by a series of steps including pre-mixing, milling, and calendering the vinyl polymer-plasticizer mixture into continuous film form, temporarily attaching the film to a carrier belt or web, coating the exposed surface of the film with an adhesive primer and subsequently with a pressure-sensitive adhesive, removing the coated film from the carrier, slitting into narrow widths, and winding the resulting adhesive tape into roll form on suitable cores. In place of calendering, other means may be employed for forming the film. Deposition from solution in a suitable volatile liquid vehicle, followed by heating to remove the vehicle and, where necessary, to homogenize the film, has some advantages, particularly in the case of the thinner films. However, the action of the calender or similar devices seems to impart some additional and desirable properties to the resulting film, particularly with respect to stretchiness and elasticity, and such methods are generally to be preferred.

Where a varnished cambric or Holland cloth carrier belt is used, sufficient adhesion of film to belt may be obtained simply by combining the two on the bottom roll of the calender under a light pressure and with the roll at a temperature of the order of 110° F. A heavy paper web with a light weight surface coating of a low tack pressure-sensitive adhesive may economically replace the varnished cambric. In any event, the carrier web is simply an aid to the successful commercial coating of the highly stretchable film, and may be dispensed with where other suitable methods of handling this type of material are available.

Primer and adhesive compositions are preferably, but not necessarily, applied from solution or suspension in a volatile liquid vehicle, as shown in the examples. The volatile vehicle is removed after each coating operation, preferably by evaporation at elevated temperatures.

Example 1

A mixture of 700 parts by weight of "Vinylite VYNS," 200 parts of "Paraplex G–25," 100 parts of dioctyl phthalate and 25 parts calcium stearate was milled together on a rubber mill, previously heated to 250° F., until homogeneous, and was then calendered to a thickness of 4 mils. The resulting transparent film was lightly bonded to a varnished cambric carrier web, and was then primed, after which it was coated with a pressure-sensitive adhesive. The primer was made by mixing 985 lbs. of an ammoniacal casein solution containing 80 lbs. of casein with 624 lbs. of an aqueous dispersion containing 38% by weight of a coplymer of 50 parts butadiene and 50 parts styrene. The primer coating was dried to remove the water, resulting in an extremely thin primer film. The formula of the pressure-sensitive adhesive was as follows:

	Parts by weight
Rubbery butadiene-styrene copolymer	100
Zinc oxide	5
Titanium dioxide	10
Yellow pigment	0.3
Oil-soluble heat-reactive phenol-aldehyde resin	12
Ester gum	40
Paraffin oil	25
Soft coumarone-indene resin	40
Heptane	300
Alcohol	About 10

In compounding the adhesive, the copolymer and pigments were first milled together. The mill base was then blended with the ester gum, paraffin oil, coumarone-idene resin, and finally with the phenol-aldehyde resin in a heated heavy duty internal mixer. After a brief further heating at a higher temperature, the batch was cooled. The heptane was then added in small portions, and sufficient alcohol was finally added to bring the viscosity to the proper value for coating. The primed film was coated with the adhesive solution, followed by drying to remove the solvent. About 6.5 to 7.5 grains of adhesive, on the dry basis, were applied to 24 square inches of the film.

The coated film was removed from the temporary liner and slit into narrow widths. The resulting tape was highly stretchable and elastic, and provided an excellent insulating and protecting covering when wound around an electrical conductor. On an irregular surface, such as a wire splice, the elasticity or regain was sufficient to provide an extremely compact covering. The tape was found to have at least about 100% stretch, and a tensile strength of about 20 lbs. per inch width.

Strips of the tape were stretched to 20% and to 50% elongation, and were then allowed to re-

tract under no load. The strips returned to their initial length in 15 to 30 minutes and in 12 hours, respectively.

An adhesive tape was similarly prepared from a film in which the same polymer, resinous plasticizer, and liquid plasticizer were in the relative proportion of 100:29.5:17.6. This film was somewhat softer and more readily stretchable. However, the adhesive coating was in permanent equilibrium with the backing, as shown by the fact that after one year of natural ageing at room temperature the adhesion and firmness values of the pressure-sensitive adhesive coating remained unchanged.

Increasing the plasticizers in the above film to a final formula of 100:30:20 yielded a composition which, in the form of 4 mil film, was found to be somewhat weak. However, this composition produced a reasonably satisfactory backing in thicknesses of about twelve mils. Pressure-sensitive adhesives coated on this backing were found to soften to a very slight extent after prolonged ageing in the final tape rolls, but the tape remained fully satisfactory for such uses as the binding of wire harnesses and the like.

On the other hand, films prepared from the above ingredients in the proportions 100:26.5:6.7, primed, and coated with adhesive, were found to be too tough and inelastic for most uses, even though the adhesive coating remained tacky and in good condition. When such films were elongated to more than approximately ten or twenty per cent of their initial length, they were found to acquire a permanent set and would not then retract to their original length. A slight increase in the proportion of dioctyl phthalate, for example, to about eight or ten parts, improved the films in this respect. On the other hand, adhesives coated on films plasticized with from 40 to 70 parts of "Paraplex G–25" and in the absence of the dioctyl phthalate were soon found to become deficient in tackiness.

Example 2

The plasticized vinyl polymer film of Example 1 was primed with a synthetic rubber-resin primer composition applied from solution in organic solvent, and coated with a natural rubber base pressure-sensitive adhesive. The resulting transparent pressure-sensitive adhesive tape was useful for wrapping splices in electrical conductors and for other purposes. The adhesive and backing were found to be in permanent equilibrium. The transparent nature of the tape was advantageous where it was desirable periodically to inspect the protected surface.

The composition used as the primer in this example consisted of a solution, in a mixture of 100 parts toluol and 20 parts methyl ethyl ketone, of 20 parts of a pure hydrocarbon thermoplastic terpene resin having a melting point of 115° F. and a zero acid number, and 25 parts of a rubbery butadiene-acrylonitrile copolymer.

The transparent pressure-sensitive adhesive was prepared by blending 288 lbs. of latex crepe rubber, 175 lbs. of the thermoplastic terpene resin having a melting point of 115° F., 2.88 lbs. of tetramethyl thiuram disulfide, and 3 lbs. of an antioxidant such as "Flectol H" (a condensation product of acetone and aniline melting at 120° C.), in solution in heptane containing a small amount of denatured alcohol as a viscosity reducing agent.

Example 3

Various pigments and colors may be added both to the backing and to the adhesive formulation of my insulating composition in order to improve the appearance, or to provide a distinctive color, or for other purposes. Heavy pigment loading of the vinyl film for example is found to improve the heat resistance.

A film twelve mils in thickness was prepared from a mixture of 700 parts "Vinylite VYNS," 200 parts "Paraplex G–25," 100 parts dioctyl phthalate, 1100 parts titanium dioxide pigment, and 30 parts calcium stearate, together with 100 parts of a mold inhibiting agent such as "Shirlan Extra" (salicyl anilide). The film was primed with the primer of Example 2 and coated with a polyacrylate base pressure-sensitive adhesive. The adhesive was composed of a copolymer of 75 parts of 2-ethylbutyl acrylate and 25 parts ethyl acrylate, tackified with a thermoplastic terpene resin, and firmed up by heating with small admixed amounts of zinc resinate and an oil soluble heat-reactive phenol-formaldehyde resin. Titanium dioxide was included as a pigment to produce a white adhesive. The produce was cut into narrow widths and wound into roll form, in this case with a varnished cambric interliner.

Samples of the tape showed approximately 100% strength at break, and had a tensile strength at break of approximately 30 lbs. per inch width. Retraction to original length from 20% elongation was complete in somewhat under five minutes, and from 50% elongation in approximately twenty-four hours.

Example 4

To produce a completely flame-resistant tape product, the primed film of Example 3 was coated with a pressure-sensitive adhesive consisting essentially of polymerized chloroprene and chlorinated diphenyl in approximately equal proportions by weight. The adhesive was applied from solution in a high aromatic content hydrocarbon solvent.

Example 5

To the film composition of Example 1 was added five parts of carbon black. The resulting film had a black glossy appearance and considerably increased tensile strength. The elasticity was somewhat reduced, but the film retracted to its original dimension from approximately 50% elongation in somewhat less than twenty-four hours.

The film was primed with the primer of Example 2 and coated with an adhesive consisting of 100 parts of a mixture of equal parts of natural rubber and Buna-S synthetic rubber, 50 parts of zinc oxide, 5 parts of carbon black, and 50 parts of heat treated wood rosin. A small amount of Flectol H antioxidant was also added, and the material was dispersed in heptane to a coatable viscosity. The resulting tape product was particularly applicable to the covering of splices in copper wires carrying an insulating coating of black pigmented plasticized synthetic polymer.

It will be seen that ~~hereinabove~~ we have described various embodiments of our invention for purposes of illustration. The novel article of our invention is a broadly new article of commerce. Prior to our invention there was no electrical or plastic tape available which was similar to the product of this invention either in performance characteristics or in appearance or handling characteristics. No pressure-sensitive adhesive tape was previously available which was of suffi-

cient thickness (i. e., 4 to 20 mils) to provide suitable dielectric strength and yet of handling characteristics such that it was readily stretchable by hand pulling to an extent of at least 50% at room temperature and substantially completely slowly retractable from an elongation of 30% as herein specified. Again, no tape of such thickness and other properties was previously available to industry in which the backing film had high resistance to both hydrocarbon oils and water and also was in "permanent equilibrium" with the pressure-sensitive adhesive coating, so as to avoid pastiness or tack loss of the adhesive. For these and other reasons, the novel article of this invention is a commercially new thing: it is a new type of tape, actually and commercially. There is no product in the prior art which resembled it, or was able to compete with it.

Where the term "rubber resin type" is used in defining the adhesive layer in the claims, it simply means a normally tacky and pressure-sensitive adhesive, such as one having properties of tack, pressure sensitivity, cohesiveness, et cetera, similar to the physical characteristics possessed by rubber resin, pressure-sensitive adhesives of the prior art.

Having described various embodiments of our invention, for purposes of illustration rather than limitation, what we claim is as follows:

1. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprised of: a stretchable and elastic film backing having a thickness of 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of a film-forming polymer of monomers including at least a major proportion of vinyl chloride, a substantially non-volatile liquid phthalyl ester plasticizer amounting to 8 to 20 parts per 100 parts of said polymer, and a soft and viscous low-acid-number alkyd plasticizer resin in amount at least equal to the amount of said liquid phthalyl ester plasticizer, the total amount of said plasticizers being about ⅓ to ½ the amount of said polymer and the proportions being such that the adhesive tape has the properties of stretch and elasticity hereafter specified without causing pastiness or tack-loss of the contacting adhesive in the roll; and a eutohesive normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing; said adhesive tape being unwindable without delamination or offsetting of adhesive, being originally stretchable by hand-pulling to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30% as herein specified.

2. An adhesive tape according to claim 1, wherein the adhesive includes a small proportion of an oil-soluble heat-reactive phenol-aldehyde resin.

3. An adhesive tape according to claim 1 in which the film-forming polymer is a copolymer of vinyl chloride and a minor proportion of vinyl acetate, said copolymer having a softening temperature of at least about 280° *F.* [C.].

4. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprised of: (1) a stretchable and elastic film backing having a thickness of 4 to 10 mils and formed of a homogeneous mixture primarily consisting of a stable blend of 70 parts of a copolymer of vinyl chloride and a minor proportion of vinyl acetate, about 10 parts of a substantially non-volatile liquid phthalyl ester plasticiser, and about 20

parts of a soft and viscous low-acid-number alkyd plasticiser resin; (2) an adhesive primer coating on the inside face of the film backing adapted to increase the anchorage of the adhesive coating; and (3) a eucohesive normally tacky and pressure-sensitive rubber-resin type adhesive coating bonded to said primer coating; said adhesive tape being unwindable without delamination or offsetting of adhesive, being originally stretchable to an extent of at least 100% at room temperature and being substantially completely retractable from an elongation of 30% as herein specified.

5. An adhesive tape according to claim 4, wherein the adhesive includes a small proportion of an oil-soluble heat-reactive phenol-aldehyde resin.

6. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprising: (1) a water-insoluble and hydrocarbon-oil-insoluble film backing of high dielectric strength containing a stabilizer and having a thickness of 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of (a) a film-forming polymer of monomers including at least a major proportion of vinyl chloride, and (b) a substantially non-volatile plasticizing material therefor in an amount within the range of at least ⅓ the weight of said polymer but in a substantially lesser amount than said polymer and comprising at least a major proportion of a non-migrating viscous plasticizer resin, and the proportions being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contacting adhesive in the roll; (2) an adhesive primer coating on the inner face of the film backing adapted to increase the anchorage of the adhesive costing; and (3) a water-insoluble normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing, over said primer coating, said adhesive coating being thin in relation to said film backing; said film backing being in permanent equilibrium with said pressure-sensitive adhesive coating so as to avoid pastiness or loss of tack of the said adhesive coating and diminution of the flexibility of said film backing; said adhesive tape being unwindable from the roll without delamination of the tape or offsetting of the adhesive, being originally stretchable in widths not greater than about one inch by simple hand pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30%, as herein specified; said tape being readily conformable to irregular surfaces in insulating wire splices and its elasticity, retractability and high adhesion value making it easy, in insulated splices, to produce snug wrappings and coverings, and said tape having sufficiently aggressive adhesiveness to remain tightly and snugly wrapped around splices and wires.

7. A pressure-sensitive adhesive tape capable of being wound upon itself in roll form and unwound therefrom without delamination or offsetting of the adhesive and comprising a water-insoluble and hydrocarbon-oil-insoluble film backing having a thickness of about 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of (a) a film-forming polymer of monomer material including at least a major proportion of vinyl chloride, and (b) a

substantially non-volatile plasticizing material therefor in an amount within the range of at least about ⅓ the weight of said polymer but in a substantially lesser amount than said polymer and comprising at least a major proportion of a non-migrating viscous plasticizer, and the proportions being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contacting adhesive; and a water-insoluble normally tacky and pressure-sensitive rubber-resin type adhesive coating united and firmly bonded to one face of said film backing; said film backing being in permanent equilibrium with said pressure-sensitive adhesive coating, so as to avoid pastiness or loss of the tack of said adhesive coating and loss of the flexibility of said film backing; said adhesive tape being capable of being wound upon itself in roll form and unwound therefrom without delamination of the tape or offsetting of the adhesive, being originally stretchable in widths not greater than about one inch by simple hand pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30%, as herein specified; said tape being readily conformable to irregular surfaces and its elasticity, retractability and high adhesion value making it easy to produce snug, smooth-fitting wrappings and coverings.

8. A pressure-sensitive adhesive tape capable of being wound upon itself in roll form and unwound therefrom without delamination or offsetting of the adhesive and comprising a water-insoluble and hydrocarbon-oil-insoluble film backing having a thickness of about 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of (a) a film-forming polymer of monomer material including at least a major proportion of vinyl chloride, and (b) a substantially non-volatile plasticizing material therefor in an amount within the range of at least about ⅓ the weight of said polymer but not greatly in excess of ½ the weight of said polymer and comprising at least a major proportion of a non-migrating viscous plasticizer resin, and the proportions of the said plasticizing material to said film-forming polymer being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contacting adhesive; and a water-insoluble, normally tacky and pressure-sensitive rubber resin type adhesive coating united and firmly bonded to one face of said film backing, said adhesive coating being thin in relation to said film backing; said film backing being in permanent equilibrium with said pressure-sensitive adhesive coating, so as to avoid pastiness or loss of the tack of said adhesive coating and loss of the flexibility of said film backing; said adhesive tape being capable of being wound upon itself in roll form and unwound therefrom without delamination of the tape or offsetting of the adhesive, being originally stretchable in widths not greater than about one inch by simple hand pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30%, as herein specified; said tape being readily conformable to irregular surfaces and its elasticity, retractability and high adhesion value making it easy to produce snug, smooth-fitting wrappings and coverings.

9. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprising: (1) a water-insoluble and hydrocarbon oil-insoluble opaque pigmented film backing of high dielectric strength and having a thickness of about 4 to 12 mils and formed of a homogeneous mixture primarily consisting of a stable blend of (a) a film-forming polymer of monomers including at least a major proportion of vinyl chloride, and (b) a substantially non-volatile plasticizing material therefor in an amount within the range of at least about ⅓ the weight of said polymer but not in excess of about ½ the weight of said polymer and comprising at least a major proportion of a non-migrating viscous plasticizer resin, and the proportions of said plasticizing material to said film-forming polymer being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contacting adhesive in the roll; (2) an adhesive primer coating on said film backing so as to increase the anchorage of the adhesive coating to the inner face of its backing when unwound from rolls thereof; and (3) a water-insoluble normally tacky and pressure-sensitive rubber resin type adhesive coating united to the inner face of said film backing, said adhesive coating being thin in relation to said film backing; said film backing being in permanent equilibrium with said pressure-sensitive adhesive coating so as to avoid pastiness or loss of the tack of the said adhesive coating and diminution of the flexibility of said film backing; said adhesive tape being unwindable from the roll without delamination of the tape or offsetting of the adhesive, being originally stretchable in widths not greater than about one inch by simple hand pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30%, as herein specified; said tape being readily conformable to irregular surfaces in insulating wire splices and its elasticity, retractability and high adhesion value making it easy, in insulated splices, to produce snug wrappings and coverings, and said tape having sufficiently aggressive adhesiveness to remain tightly and snugly wrapped around splices and wires.

References Cited in the file of this patent or the original patent

UNITED STATES PATENTS

Number	Name	Date
1,929,453	Semon	Oct. 10, 1933
1,966,856	Groff	July 17, 1934
2,010,963	Robertson	Aug. 13, 1935
2,059,055	Studt	Oct. 27, 1936
2,170,949	Morgan	Aug. 29, 1939
2,312,925	McBurney et al.	Mar. 2, 1943
2,322,903	Wilkoff	June 29, 1943
2,332,265	Schmidt	Oct. 19, 1943
2,349,413	Hemperly	May 23, 1944
2,385,319	Eustis	Sept. 18, 1945
2,395,419	Mitchell	Feb. 26, 1946
2,429,223	Eustis et al.	Oct. 21, 1947
2,451,183	Taft	Oct. 12, 1948
2,462,977	Kitchin et al.	Mar. 1, 1949
2,610,910	Thomson	Sept. 16, 1952

Office - Supreme Court, U.S.
FILED
DEC 16 1957
JOHN T. FEY, Clerk

IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1957.

No. 673

MINNESOTA MINING AND MANUFACTURING COMPANY,
Petitioner,

vs.

SEARS ROEBUCK AND COMPANY and THE PLYMOUTH RUBBER COMPANY, INC.,
Respondents.

PETITION FOR WRIT OF CERTIORARI

To the United States Court of Appeals for the Fourth Circuit.

LAWRENCE C. KINGSLAND,
ESTILL E. EZELL,
7912 Bonhomme Avenue,
St. Louis 5, Missouri,
HAROLD J. KINNEY,
900 Bush Avenue,
St. Paul 6, Minnesota,
M. K. HOBBS,
First National Bank Building,
Platteville, Wisconsin,
WELCH JORDAN,
Jefferson Standard Building,
Greensboro, North Carolina,
Attorneys for Petitioner.

ST. LOUIS LAW PRINTING CO., 415 North Eighth Street. CEntral 1-4477.

SUBJECT INDEX.

	Page
Opinions below	2
Jurisdiction Supreme Court	2
Questions presented	3
Statute involved	5
Statement of the case	6
Basis of Federal jurisdiction in District Court	10
Argument amplifying reasons for allowing writ	11
I. An important question of patent law has been decided in a manner in conflict with the decisions of this court	11
II. The Supreme Court has not decided since the advent of the Patent Act of 1952, which gives first statutory recognition to the doctrine of equivalents, whether an equivalent must have been known at the date of the patent	19
Conclusion	22
Appendix:	
Opinion of Court of Appeals, April 1, 1957	23
Judgment in question	37
Opinion of Court of Appeals, October 18, 1957	38
Order denying motion to reopen, etc.	41
Opinion of District Court	42
Pertinent Findings of Fact of District Court	49

TABLE OF AUTHORITIES CITED.

Cases.

American Sulphate Pulp Co. v. Howland Falls Pulp Co., 80 F. 395, 410, 1 Cir., 1897	21
Finkelstein v. Kress, 113 F. (2d) 431, 433	21

Graver v. Linde, 339 U. S. 605, 609, 610.....11, 17, 18

Imhaeuser v. Buerk, 101 U. S. 647, 655, 656..... 21

Kinlock Telephone Co. v. Western Electric Co., 113 F. 652, 657, 8 Cir., 1902..... 21

Mesarosh v. United States, 352 U. S. ...; 1 L. ed. 2d 1, 9 (Nov. 5, 1956) 17

Polygon Products Corp. v. Kant-Rust Products Corp., 292 F. 569, 572, 3 Cir., 1923..... 21

Seymour v. Osbourne, 11 Wall. (U. S.) 516, 544, 546, 20 L. Ed. 33, 38, 39.....11, 13, 18

Technical Tape Corporation v. Minnesota Mining & Manufacturing Company, 247 F. (2d) 343..... 20

U. S. Industrial Chemicals Co. v. Carbide & Carbon Chemicals Co., 315 U. S. 668.....3, 11, 13, 14, 15, 18

U. S. v. Yellow Cab Co., 338 U. S. 388, 341, 342....11, 17, 18

United States v. National Association of Real Estate Boards, 339 U. S. 485, 495 .....11, 17, 18

Webster Loom v. Higgins, 105 U. S. 580, 585, 586, 26 L. Ed. 1177, 1179.....11, 12, 18

Rule.

Rule 52 (a) 17, 19

Statutes.

Section 112, Title 35, U. S. C. 3, 5, 11, 18, 19, 20

Section 1254 (1), Title 28, United States Code..... 3

Section 1338 (a), Title 28, U. S. C. 10

Textbook Cited.

Walker on Patents, Deller's Edition, page 1072..... 20

IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1957.

No. .....

MINNESOTA MINING AND MANUFACTURING COMPANY,
Petitioner,

vs.

SEARS ROEBUCK AND COMPANY and THE PLYMOUTH RUBBER COMPANY, INC.,
Respondents.

PETITION FOR WRIT OF CERTIORARI

To the United States Court of Appeals for the Fourth Circuit.

To the Honorable Chief Justice of the United States, and the Associate Justices of the Supreme Court of the United States:

Your Petitioner prays that a Writ of Certiorari issue to the United States Court of Appeals for the Fourth Circuit to review that Court's Judgment filed April 1, 1957, and its order filed October 18, 1957, denying petitioner's motion to reopen and petition for rehearing.

OPINIONS BELOW.

A copy of the Opinion of the District Court, reported at 141 F. Supp. 686 and 110 USPQ 87, is found in the certified record, Vol. I, p. A19, and is reproduced in the appendix hereto at page 42.* The District Court also made separate findings of fact, pertinent parts of which are reproduced in the Appendix hereto (App. 49; R I, A-1).

A copy of the Opinion of April 1, 1957 of the Court of Appeals of the Fourth Circuit is reproduced in the record, Vol. IV, pp. 3-18, and in the appendix at page 23. This Opinion is reported at 243 F. 2d 136.

A further opinion of the Court of Appeals dated October 18, 1957 denying (1) a Petition for Rehearing and (2) a Motion to Reopen on ground of newly discovered evidence, each filed by the Petitioner (plaintiff) is reproduced in the record, Vol. IV, pp. 27-31, and at page 38 of the appendix hereto. This Opinion is reported at 115 USPQ 208.

JURISDICTION.

1. The judgment of the Court of Appeals for the Fourth Circuit is dated and was filed April 1, 1957 (App. 37; R IV, 19).

2. On April 27, 1957, within the thirty day period permitted by the rules of the Court of Appeals for the Fourth Circuit, that Court filed an order extending until June 1, 1957 Petitioner's time to apply for a rehearing (R IV, 23). On May 29, 1957, within the extended time, Petitioner filed in the Court of Appeals its petition for rehearing (R IV, 24). A rehearing was denied October 18, 1957 (R IV, 33), opinion (R IV, 27).

---

* The certified record is in four volumes and Volume III, page 71, for example, is referred to as R III, 71; and the appendix hereto, page 41, for example, is referred to herein as App. 41.

3. The jurisdiction of this Court is invoked under Section 1254 (1) of Title 28, United States Code to review a judgment which reversed the judgment (R I, A15) of the United States District Court for the Middle District of North Carolina.

QUESTIONS PRESENTED.

1. Since a patent is addressed to the man "skilled in the art to which it pertains" (Sec. 112, Title 35, U. S. C.), and since what a patent teaches such man is a question of fact, can a Court of Appeals **justifiably** overrule the concurring findings, **as to what the patent teaches**, of the Board of Appeals of the Patent Office and of the District Court based upon the testimony of men skilled in the art, and as judges unskilled in the art substitute their inexpert reading of the patent for that of the experts?

2. All of the conditions of equivalency being met (the performance of the same functions in the same way to get the same result), is infringement avoided because the equivalent was not known at the date of the patent?

3. When a third party manufacturer (Rohm & Haas Co.), by adjusting its manufacturing processes to combine into one plasticizer for vinyl resins the functions of two plasticizers and announces to the trade that it has done so after the date of the Oace patent, does one who uses such tailored plasticizer escape infringement, under the doctrine of equivalents, of the claims of the Oace patent?

(a) Does one thus escape infringement of original claims 1, 3 and 4 of Oace, which specify two plasticizers?

(b) Does one thus escape infringement of reissue claims 6 to 9 of Oace, which do not require two plasticizers?

4. Is the doctrine of **U. S. Industrial Chemicals Co. v. Carbide & Carbon Chemicals Co.**, 315 U. S. 668, namely,

that a "mandatory" step of a process patent may not be omitted in a reissue, applicable to questions of validity and infringement of the Oace reissue combination claims in suit?

(a) Is such doctrine applicable where the Oace original and reissue claims are directed to a new article of manufacture, which is a pioneer invention, comprising a new combination of elements and the accused tape article employs a single plasticizer component in place of two plasticizer components of the original Oace claims, but which single component performs the same function in the same manner and with the same result?

(b) On the facts stated in (a), are not the original and reissue claims for the same invention?

(c) Construing the Oace reissue claims (6 to 9) so as not to require two plasticizers, as they were interpreted by the Patent Office, and as they were construed by the District Court in holding them to be infringed by the Plymouth tape containing a single liquid resinous plasticizer, are they valid?

5. (a) Since the plasticizers of the Oace patent and in the accused tapes function in the vinyl resin film backing of the tape in a purely physical manner, is it necessary in order to establish legal equivalency that chemical equivalency of the plasticizers must also be shown?

(b) Or is it sufficient in establishing equivalency between such substances to show that they perform the same function, in the same manner and with the same result, irrespective of whether or not they are chemically the same?

6. When it is shown for the first time, on a Motion to Reopen for the production of newly discovered evidence

further to support the fact that Paraplex G-25 had changed since Oace made his invention, that the Court of Appeals, in its findings in reversal of those of the District Court, placed reliance upon stifled recollection and dubious testimony of witnesses (at Rohm & Haas Co.) who were admonished by their corporate superior "not to try to recollect," is it proper under such circumstances for the Court of Appeals both to deny the Motion to Reopen and adhere to its reversal of the District Court's findings?

STATUTE INVOLVED.

The statute involved is Sec. 112, Title 35, United States Code, stating the requirements of the specification of a patent as addressed to persons skilled in the art, and for the first time making the recognition of equivalents a statutory requirement. That section reads as follows:

"§ 112. Specification.

"The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

"The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

"An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof. July 19, 1952, c. 950, § 1, 66 Stat. 798."

This section, effective January 1, 1953, replaced Sec. 33, Title 35, United States Code, set forth in a footnote;* and applies to "further proceedings on applications pending" on January 1, 1953, including the Oace reissued application then pending, see Sec. 4 (a) of the Patent Codification Act of July 19, 1952.

STATEMENT OF THE CASE.

This is a patent infringement action based on Oace et al. United States Reissue Letters Patent No. 23,843, issued to petitioner on June 29, 1954** (R I last patent). The original patent was applied for January 12, 1946, and was granted July 10, 1951. The patent relates to a stretchable and retractable pressure-sensitive insulating tape commonly sold in roll form.

The District Court held the patent valid and infringed (141 F. Supp. 686, App. 42). The Court of Appeals, Fourth

---

* "§ 33. Application for patent; description; specification and claim.

"Before any inventor or discoverer shall receive a patent for his invention or discovery he shall make application therefor, in writing, to the Commissioner of Patents, and shall file in the Patent Office a written description of the same, and of the manner and process of making, constructing, compounding, and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same; and in case of a machine, he shall explain the principle thereof, and the best mode in which he has contemplated applying that principle, so as to distinguish it from other inventions; and he shall particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery. The specification and claim shall be signed by the inventor. No plant patent shall be declared invalid on the ground of noncompliance with this section if the description is made as complete as is reasonably possible. R. S., § 4888; Mar. 3, 1915, c. 94, § 1, 38 Stat. 958; May 23, 1930, c. 312, § 2, 46 Stat. 376."

** Two suits initially were filed, but were consolidated for trial. The defendants in one suit did not appeal from the judgment adverse to them, and are not respondents herein.

Circuit, reversed as to infringement (243 F. 2d 136, App. 23); and denied a rehearing October 18, 1957 (115 USPQ 208, App. 38).

The specification of the reissue is identical with the original except for the italicized portions in the reissue. These portions do not contain any additional disclosure of a tape or how to make it, but simply comment on the novelty of the tape or give a definition of a term (Finding 32, App. 49). The claims added by the reissue, viz., 6, 7, 8 and 9, are in italics. Claims 1, 3, 4 and 6-9 are in issue. Original Claim 1 and reissue Claim 6 are typical.

The central problem to which the patent in suit is addressed, and which it solved, was to provide an easily stretchable and highly elastic pressure-sensitive adhesive electrical insulating tape comprising a well-bonded, water-insoluble, non-corrosive, normally tacky and pressure-sensitive coating on a plasticized vinyl chloride polymer film, which plasticized film backing is in permanent equilibrium with the adhesive (Finding 30, App. 49).

By "permanent equilibrium" it is meant that the pressure-sensitive adhesive layer neither softens nor loses its tack on prolonged contact with the plasticized film backing layer because of migration or exudation of the plasticizer from the film backing (Oace patent, Col. 2, line 55, to Col. 3, line 12).

Commercially and practically, the patented tape is an entirely new thing, broadly differing in character and kind from anything which preceded it (Opinion, CA 4, App. 25). The new tape was "revolutionary"; its commercial success was "phenomenal" (D. C. Opinion, App. 48). Sales of the Oace tape by petitioner began in February, 1945, and grew from $8,000.00 in 1945 to over $8,000,000.00 in 1953 (R II, 180).

The patentees, in setting "forth the best mode contemplated by the inventor of carrying out his invention" (Sec.

112, Title 35) "employ with the vinyl chloride polymer a combination of modifiers (plasticizers) including a substantial but minor amount. . . of a low molecular weight liquid plasticizer such as dioctyl phthalate, together with a substantially equal or somewhat greater amount of high molecular weight resinous type plasticizer" (Oace Patent, Col. 3, lines 21-35).

Paraplex G-25 is the preferred example of the resinous type plasticizer (Oace Patent, Col. 3, lines 33-35). Paraplex G-25 is made by Rohm & Haas Co., formerly Resinous Products & Chemical Corp. Paraplex G-25, was first offered for sale in 1943. Paraplex G-40, another Rohm & Haas plasticizer, was first available in late 1945. The Oace patent was granted July 10, 1951.

The plasticizers in the vinyl backing modify it so that it becomes stretchable and retractable. This modification of an ordinarily inelastic substance is a purely physical phenomenon, with no chemical reaction involved. To this fact both experts agreed (R II, 27, 95).

The major part of the accused tape employs Paraplex G-40 as the sole plasticizer; a very minor part employs new vintage (1954 or later) Paraplex G-25. Both types of tape were held not to infringe by the Court of Appeals in reversing the District Court. The latter Court held that recent vintage G-25 had been modified by polymerization processes (Finding 49, App. 53) and that it and the later G-40 were each the equivalent of early vintage G-25 plus dioctyl phthalate.

Each party recognized* that in view of the reference in Column 3 of the patent specification to Paraplex G-25, it was important to determine whether there had been a change in that product over the years, from and after the

* "I felt it important to learn whether or not any change had been made in G-25 over the years" (Kirkpatrick, counsel for defendants, R III, 17).

time the patentees worked with it in 1944-45. Paraplex G-25 is made by polymerizing the reaction product of propylene glycol and sebacic acid (Finding 38, App. 50). Paraplex G-40 is the polymerized reaction product of adipic acid and propylene glycol (Finding 38, App. 50).

In the process of polymerization, the composition of the resultant product depends upon the conditions employed, for example, time, temperature, catalyst, and other factors, so that different types of polymers can be produced as desired (Finding 39, App. 50).

Paraplex G-40 and new vintage Paraplex G-25 are represented by the manufacturer (Rohm & Haas) to be "tailor-made", and to combine to marked degree many of the desirable features of liquid ester plasticizers, such as dioctyl phthalate, with those features obtainable in resinous plasticizers (Finding 40, App. 51).

In 1954, the first year in which anyone was able to make tape with G-25 as the sole plasticizer, Rohm & Haas announced in one of its publications (Defendants' Exhibit 50, R II, 189-190):

> "* * * Research investigators, therefore, focused their efforts on **tailoring** plasticizers to meet **specific**, often stringent, application and process requirements * * *" (Emphasis added.)

"Electrical Tape.

> "**The requirements for electrical tape are very critical** because of the need for a combination of good electrical properties, resistance to migration into rubber-based adhesives employed, and freedom from exudation on exposure to high humidity." (Emphasis added.)

Although a patent is drafted in terms addressed to men skilled in the art, the Court of Appeals on its own reading of the Oace patent set aside (1) the administrative

ruling of the Board of Appeals of the United States Patent Office in granting the reissue claims which find response in a resinous plasticizer used solely; (2) the testimony of the experts on both sides that the patent teaches the use of single resinous plasticizer and does not require two plasticizers (R II, 45, 91-92); and (3) the findings of the District Court as to what the patent teaches (Finding 31, App. 49), and its corollary findings as to equivalence and infringement.

The District Court found that G-25 had changed significantly over the years (Finding 49, App. 52), but the Court of Appeals rejected this finding. The rejection was based upon a letter from patent counsel for Rohm & Haas, stating as a conclusion that there had been "no significant change" in G-25 since it was first sold, which letter is quoted in a footnote in the Opinion of the Court of Appeals (App. 34).

It was shown in petitioner's motion to reopen, and was not disputed, that the Rohm & Haas' witnesses who testified that G-25 had not changed significantly were under a stifling mandate from company management:

> "* * * Above all, it is important that you do not undertake to recall discussions or events which took place some years ago involving our plasticizers and vinyl polymers, nor should you express opinions on matters relating to this dispute * * *" (R III, 27).

BASIS FOR FEDERAL JURISDICTION IN THE DISTRICT COURT.

This is a patent infringement suit brought in the District Court of the United States for the Middle District of North Carolina under authority of Section 1338 (a), Title 28, U. S. C., providing exclusive, original jurisdiction in the District Courts of the United States of any civil action arising under Acts of Congress relating to patents.

ARGUMENT AMPLIFYING REASONS FOR ALLOWING THE WRIT.

I.

An Important Question of Patent Law Has Been Decided in a Manner in Conflict With the Decisions of This Court.

a) The arbitrary substitution by the Court of Appeals of its inexpert views as to what the technical Oace specification teaches men skilled in the art to which it pertains, contrary to the determination of the Patent Office Board of Appeals in granting the reissue and contrary to the Findings of Fact of the District Court based upon the concurring testimony of the **experts** of **both** parties, is in direct conflict with this Court's directions in **Webster Loom v. Higgins**, 105 U. S. 580, 585, 586, 26 L. Ed. 1177, 1179; **Seymour v. Osbourne**, 11 Wall. (U. S.) 516, 544, 546, 20 L. Ed. 33, 38, 39; **U. S. Industrial Chemicals v. Carbide & Carbon Chemicals Corp.**, 315 U. S. 668, 678.

b) In so substituting it's necessarily inexpert views for that of testimony of men skilled in the art, the Court below ignores the provisions of Rule 52 (a) of the Federal Rules of Civil Procedure promulgated by this Court and strongly supported in **Graver v. Linde**, 339 U. S. 605, 609, 610; **U. S. v. Yellow Cab Co.**, 338 U. S. 388, 341, 342; **United States v. National Association of Real Estate Boards**, 339 U. S. 485, 495, and other cases.

c) This unwarranted departure from recognized judicial procedure does violence to the provisions of Section 112, Title 35, U. S. C., that a patent is directed to persons skilled in the art.

By whom and in what manner it is to be determined what a patent teaches to persons skilled in the art to which

it pertains is a question of grave public importance. It is a question which affects the trial of all patent infringement suits and the form in which patent specifications should be filed in the Patent Office.

What that teaching is, can be determined only from evidence adduced from those skilled in the art. The Supreme Court has said so unmistakably.

This Court in the **Webster Loom** case, supra, pointed out at quite some length that a technical patent specification is drawn in language for the man skilled in the art to which the invention pertains. The Court, for comparison, referred to astronomy and the understanding by a fellow astronomer of a technical report which would be "all Greek to the unskilled in science", and then stated (p. 586):

> "Applying these remarks to the specification before us and referring to the extract already made, setting forth the nature and object of the invention, it is easy to conceive that its meaning **may be plain to those for whose use it is intended.** They know at once what is meant by the terms, 'reciprocating or driving slide', 'sliding bar', 'withdrawing and inserting devices', 'trough', 'wire', 'wire box', 'lay', etc., etc. They also understand the movements referred to, and the objects to be attained by each device. (Emphasis added.)
>
> "In like manner, if we follow the specification in its description of the invention in detail, with the reference to the drawings and the closing summary of the patentee's claims, the same method of interpretation will be applicable. And as **it cannot be expected that the court will possess the requisite knowledge for this purpose**, it becomes necessary that it should avail itself of the light furnished by the evidence to enable it to understand the terms used in the patent and the devices and operations described or alluded to therein. * * * " (Emphasis added.)

In **Seymour v. Osbourne**, supra, this Court in considering a reissue said (p. 546):

> "* * * Cases, doubtless, arise where the language of the specification and claim, both of the surrendered and reissued patents, is so interspersed with technical terms and terms of art that the testimony of scientific witnesses is **indispensable** to a correct understanding of its meaning. Both parties in such a case would have a right to examine such witnesses, **and it would undoubtedly be error** in the court to reject the testimony. * * *" (Emphasis added.)

In **U. S. Industrial Chemicals v. Carbide & Carbon Chemicals Corp.**, supra, this Court in reviewing a reissue and original specification said (p. 678):

> "Although it is the duty of a court to determine for itself, by examination of the original and the reissue, whether they are for the same invention, it is permissible, and often necessary, to receive expert evidence to ascertain the meaning of a technical or scientific term or term of art so that the court may be aided in understanding not what the instruments mean but what they actually say."

How can the Court of Appeals ignore the interpretation of the experts in the Patent Office and the expert witnesses who testified at the trial and independently interpret the following portion of the Oace patent specification:

> "It will be understood that, where specific ratios of specific polymers, low molecular weight plasticizers, and high molecular weight plasticizers are described in the examples, substitution of equivalent but somewhat different materials may require alteration of these ratios in order to obtain equivalent results, all in conformity with well-recognized principles" (Oace patent, col. 5, lines 31 to 38).

In reversing the Trial Court, and in rejecting its findings as to what the patent specification teaches the man skilled in the art, the Court of Appeals is establishing the rule that the technical explanations of a patent specification (not the claims) are to be read solely by non-experts in the art—judges, to be specific—, and that such reading takes precedence over the concurring reading and interpretation of the technology given by the Patent Office Board of Appeals and by witnesses skilled in the art.

The Court of Appeals based its decision in large measure upon a misapplication of the decision of this Court in **U. S. Industrial Chemicals, Inc., v. Carbide & Carbon Chemicals Corp.**, 315 U. S. 668. If the teaching of the Oace patent is that found by the Patent Office in granting the reissue and as confirmed by the Findings of the District Court, the **Industrial Chemicals** case has no application. That case, quoted at length in the Court of Appeals Opinion (App. 29), held that a reissue was invalid which omitted a "mandatory" step of the original patent, and hence was not for the same invention.

The electrical tape of Oace is made by producing a stretchable and retractable vinyl film backing and coating it with an adhesive. To prevent injury to and loss of tack in the adhesive, Oace taught that the plasticizer system used in the vinyl backing had to have certain characteristics.

In the specification, Oace mentioned more than one plasticizer. He described in some detail a combination of two plasticizers, one a so-called resinous plasticizer, Paraplex G-25 by name, to which he added a liquid dioctyl phthalate. Another resinous plasticizer was polymerized ethyl acrylate.

An important issue arose in the District Court as to the meaning of the language of the Oace patent description, namely, whether the language taught (a) that two plasti-

cizers, one resinous and one liquid, are necessary, or (b) that a resinous plasticizer such as ethyl acrylate alone, or other single resinous plasticizers incorporating the combined functions of old vintage Paraplex G-25 and dioctyl phthalate could suffice to make the new product. The District Court determined, as did the Patent Office, that the Oace patent does not require the use of two plasticizers and teaches the use of a single plasticizer.

It needs no comment that such an issue is highly technical, and depends upon what the specification means to the man skilled in the art. At the trial, the expert for **each side** testified that the specification taught that a single resinous plasticizer, ethyl acrylate, could be used. Other testimony revolved around whether G-25 had been changed since the specification was written, so that new vintage G-25 can be used alone. On whether G-25 had been changed, there was a mass of conflicting evidence.

We do not analyze all the evidence; we merely indicate enough to demonstrate that the issue was deeply technical, and that, in the District Court, the issues were resolved by findings of fact, based upon the testimony of expert witnesses, and upon other evidence of specialized meaning to those skilled in the art. These findings were all in favor of Petitioner.

Holding that the Oace patent specification did not teach those skilled in the art that a single resinous plasticizer is sufficient to make the new tape product, without any added "liquid" plasticizer, the Court of Appeals reversed these findings of fact.

Finding as it did that the Patent Office, the experts, and the District Court were wrong, and finding that the Oace patent specification teaches only the use of two plasticizers, the Court of Appeals, relying upon the **Industrial Chemicals** case, determined there was no infringement because the accused tape used only one plasticizer, and held that it omitted an essential ingredient.

Irrespective of the specification as a whole, the Court of Appeals took an isolated paragraph* from the Oace patent, and the Court itself interpreted such language to mean that always and without exception, two plasticizers are necessary, despite the contrary testimony and evidence upon all of which the District Court based its findings.

It is quite evident from the decision that the Court of Appeals treated the language which it quoted, as a disclaimer of all solely resinous plasticizers, despite all the testimony of expert witnesses and other evidence, that to those skilled in the art, the patent as a whole **does** teach that resinous plasticizers alone, such as G-40, and **new** G-25 (changed since 1945), can be used without any "liquid".

Substituting its own concepts of the technology taught, for that of the findings of the District Court, the Court of Appeals flatly said:

> "The specification does not show that ethyl acrylate polymer may be used as the sole plasticizer but, to the contrary, clearly teaches that it is to be used in place of the resinous plasticizer called for by the patent."

Everything said by the Court of Appeals focuses toward the one proposition, that, to it, based solely upon its reading of the specification, and disregarding all evidence of those skilled in the art, including the interpretation of the Patent Office, the findings of the District Court were

---

* "While resinous or high molecular weight modifiers such as 'Paraplex G-25' are themselves capable of producing the desired degree of strength, stretch and elasticity in vinyl chloride polymer films, and furthermore are generally classed as 'non-migrating' or 'permanent' type modifiers or plasticizers, it is surprisingly found that these materials do not provide for permanent equilibrium of adhesive and backing as herein defined. Instead, it has been shown that pressure-sensitive adhesives in prolonged contact with highly stretchable and elastic films consisting solely of vinyl polymer and resinous modifier lose a great deal, if not all, of their initial tackiness or pressure-sensitivity."

"not in accord with the great weight of the evidence."* In short, the Court of Appeals has substituted its lay reading of the specification for that of the persons skilled in the art, to whom by statute the patent is addressed

Rule 52 (a) provides "* * * Findings of fact shall not be set aside unless clearly erroneous, and due regard shall be given to the opportunity of the trial court to judge of the credibility of the witnesses * * *." In respect thereto, in **United States v. National Association of Real Estate Boards**, 339 U. S. 485, this Court said (p. 495):

> "It is not enough that we might give the facts another construction * * *."

In **U. S. v. Yellow Cab Co.**, 338 U. S. 388, Mr. Justice Jackson pointed out that where the evidence would support a conclusion either way (p. 342):

> "* * * Such a choice between two permissible views of the weight of evidence is not 'clearly erroneous' * * *."

(In the instant case, **both** experts testified that the Oace specification taught them to make the tape using polymerized ethyl acrylate as the sole plasticizer.)

In **Graver v. Linde**, 339 U. S. 605, this Court in discussing equivalence as a fact determination said (p. 609):

> "A finding of equivalence is a determination of fact. Proof can be made in any form; through testi-

---

* In weighing the evidence, the Court of Appeals gave prime effect to a letter of an attorney for Rohm & Haas Co.: see Opinion, page 14 (R IV, 16; App. ...). This letter and other testimony of Rohm & Haas people was later shown to be the product of stifled recollection and regimentation, as the Rohm & Haas people had been directed by top management: "Above all, it is important that you do not undertake to recall . . ." (R III, 27). Such testimony "polluted" the "waters of justice": *Mesarosh v. United States*, 352 U. S. ...; 1 L. ed. 2d 1, 9 (Nov. 5, 1956). This illustrates the hazard involved when a Court of Appeals indulges in an almost cavalier disregard of the District Court's findings.

mony of experts or others versed in the technology; by documents, including texts and treatises; and, of course, by the disclosures of the prior art. Like any other issue of fact, final determination requires a balancing of credibility, persuasiveness and weight of evidence. It is to be decided by the trial court and that court's decision, under general principles of appellate review, should not be disturbed unless clearly erroneous. Particularly is this so in a field where so much depends upon familiarity with specific scientific problems and principles not usually contained in the general storehouse of knowledge and experience."

What the Court of Appeals has done is to constitute itself a board of technicians, and, as such, to undertake to second-guess the experts on what the man skilled in the art learns from the specification.

Since, by virtue of the provisions of Section 112, a patent is addressed to the man skilled in the art, it would seem to be a matter of ineluctable logic that what is taught and disclosed by the patent is a question of fact, for no one except the person skilled in the art can answer the question as to what is taught and disclosed to him. The skilled person subjectively knows the answer. The unskilled person must be told.

Consequently, the Court of Appeals has:

(1) Ignored the admonition of this Court as expressed in **Webster Loom v. Higgins, Seymour v. Osbourne,** and **Industrial Chemicals v. Carbide & Carbon**;

(2) Ignored the provisions of Rule 52 (a) as interpreted in **Graver v. Linde, U. S. v. Yell w Cab Co.,** and **U. S. v. National Association of Real Estate Boards**; and

(3) Ignored the mandate of Section 112 that a patent is addressed to persons skilled in the art.

The Court below decided the case as it might interpret an ordinary contract, in which capacity it is expert. But by assuming an expertness in technology it ran counter to the directives of this Court, counter to the requirement of the statute (35 U. S. C. 112), and afoul of Rule 52 (a).

For these compelling reasons, it is of importance to the public generally that the writ be granted in order to secure harmonious administration of justice.

II.

The Supreme Court Has Not Decided Since the Advent of the Patent Act of 1952, Which Gives First Statutory Recognition to the Doctrine of Equivalents, Whether an Equivalent Must Have Been Known at the Date of the Patent.

The question of whether an ingredient, to be an equivalent under the doctrine of equivalents, must have been known at the date of the patent, arose in this case. In the Opinion of April 1, the Court said (App. 36): "... but it is certain that the inventors were unaware of this fact. ..." The fact referred to is that the polymerized products, modified G-25 and G-40, could be used alone. Chief Judge Parker, at the oral argument of petitioner's motion to reopen, interrogated counsel for both parties as to whether an equivalent had to be known at the date of the patent, and in the Opinion of the Court of Appeals, dated October 18, 1957, that question

---

* The Court of Appeals does not deny that the G-40 and modern G-25 of defendants' tape are actually equivalent, and acknowledges: "It may be that the lower weight molecules in the resinous plasticizers perform the function which the patent attributes to the liquid plasticizer in making the finished product ..." (App. 36). The District Court affirmatively found that G-40 (and modern G-25) "functions in the same way to give essentially the same results" and "produces the same results in the same way by the same or equivalent means as the examples of the patent in suit" (App. 51-54, Findings 44-47 and 50-52).

is referred to. In a footnote to the Opinion cases are cited with holdings contrary to each other (App. 41).

Walker on Patents, Deller's Edition, page 1702, cites a number of Supreme Court decisions as holding that a claimed equivalent need not have been recognized as such at the time of the granting of the patent. The footnote of the Court of Appeals cites Supreme Court cases as asserting a contrary view.

But each Supreme Court case cited, whether by **Walker** or by the Court of Appeals, was decided prior to the enactment of the Patent Act of 1952, United States Code, Title 35.

The applicable portion of the Act is the third paragraph of Section 112 (supra, page 5), which provides:

> " . . . and such claim shall be construed to cover the corresponding structure, material or acts described in the specification **and equivalents thereof.**" (Emphasis added.)

In this provision is found the first **statutory** recognition of the doctrine of equivalents, but the doctrine has been case law since a very early date, both in the Supreme Court and other federal courts.

The statutory requirement to recognize equivalents makes no reference to any date as to when an equivalent must be known. The omission of such limitation indicates legislative intent to impose none.

Recognized authority, as **Walker**, and the courts differ on what the Supreme Court has held prior to the statute. The Court of Appeals for the Second Circuit held as recently as August 1, 1957, that an equivalent need not have been known at the date of the patent.[1] And in an

---

[1] *Technical Tape Corporation v. Minnesota Mining & Manufacturing Company*, 247 F. (2d) 343.

earlier case[2] analyzed **Imhaeuser v. Buerk**, 101 U. S. 647, 655, 656, and determined that that decision did not require a claimed equivalent to have been known at the date of the patent, for the **Imhaeuser** case dealt only with equivalents which were known at the date of the patent.

The First, Third, and Eighth Circuits have expressed views similar to that held by the Second Circuit. **American Sulphate Pulp Co. v. Howland Falls Pulp Co.**, 80 F. 395, 410, 1 Cir., 1897; **Polygon Products Corp. v. Kant-Rust Products Corp.**, 292 F. 569, 572, 3 Cir., 1923 ("To require that would be to require prophesy as the price of patenting"); **Kinlock Telephone Co. v. Western Electric Co.**, 113 F. 652, 657, 8 Cir., 1902.

Reference has been made above to the statement of the Fourth Circuit in this case that the inventors did not know of the equivalence of G-40 and modified G-25.

The title of the 1952 Patent Act is "An Act to Revise and Codify the Laws Relating to Patents and the Patent Office, and to Enact Into Law Title 35 of the United States Code Entitled 'Patents.'"

If the provisions of the third paragraph of Section 112 are viewed as a revision, there is presented the question of whether the absence of any limitation as to when an equivalent is required to be recognized as such, removes any such limitation, as imposed by some decisions.

On the other hand, if the provisions of the new act are viewed as a codification of existing law and decisions, a pertinent inquiry is: What was such existing law?

In either case, there is presented for definitive determination an issue of first impression. What does the statute mean? Does prior case law impose limitations not

---

[2] *Finkelstein v. Kress*, 113 F. (2d) 431, 433.

expressed? Did the Congress intend to revise case law? If it did, what was such case law?

These questions are of vital importance in the patent field. With most valid patents, the issues of infringement are complicated by questions of equivalence, for few accused articles or processes are Chinese copies.

This case presents questions which have not been, but should be, authoritatively and definitively settled by this Court. So far as is known to petitioner, this case presents to the Supreme Court the first occasion upon which call is made upon it to interpret Section 112 in two vital aspects: (1) "the person skilled in the art to which it pertains," and (2) "equivalents thereof."

CONCLUSION.

For the reasons stated, this Petition for Writ of Certiorari should be granted.

Respectfully submitted,

LAWRENCE C. KINGSLAND,
ESTILL E. EZELL,
HAROLD J. KINNEY,
M. K. HOBBS,
WELCH JORDAN,
Attorneys for Petitioner.

December 12, 1957.

OPINION OF THE COURT OF APPEALS.

(April 1, 1957)

Soper, Circuit Judge.

The complaint in this suit charges infringement of United States Reissue Patent No. 23,843 granted on June 29, 1954, to Ralph J. Oace, Robert Burns Snell, and Esther E. Le Page, assignors to Minnesota Mining and Manufacturing Company, the plaintiff in the District Court. The original patent No. 2,559,990 was dated July 10, 1951, and the application for reissue was filed July 9, 1952.

The invention relates to the insulation and protection of electrical conductors. For this purpose the patent specifies an adhesive insulating tape, composed of a film backing mixed with a non-volatile liquid plasticizer, a soft and viscous resinous plasticizer, and an adhesive coating united to the inner surface of the film backing. The claims of the reissued patent in issue in the pending case are claims 1, 3 and 4, which are identical with like numbered claims of the original patent, and claims 6, 7, 8 and 9, which are new in the reissued patent. Typical claims 1 and 6 are set out in full below [1]

---

[1] *Claim 1*

"1. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprised of: a stretchable and elastic film backing having a thickness of 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of a film-forming polymer of monomers including at least a major proportion of vinyl chloride, a substantially non-volatile liquid phytalyl ester plasticizer amounting to 8 to 20 parts per 100 parts of said polymer, and a soft and viscous low-acid-number alkyd plasticizer resin in amount at least equal to the amount of said liquid phthalyl ester plasticizer, the total amount of said plasticizers being about ⅓ to ½ the amount of said polymer and the proportions being such that the adhesive tape has the properties of stretch and elasticity hereafter specified without causing pastiness or tack-loss of the contacting adhesive in the roll; and a cucohesive normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said

The defendants are Sears, Roebuck and Company and Plymouth Rubber Company, Inc. Sears sold a stretchable and retractable pressure-sensitive tape under the brand name of "Homart", which was manufactured by Plymouth and is alleged to have infringed the patent. The main de-

---

film backing; said adhesive tape being unwindable without delamination or offsetting of adhesive being originally stretchable by hand-pulling to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30% as herein specified."

Claim 6

"6. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprising; (1) a water-insoluble and hydrocarbon-oil-insoluble film backing of high dielectric strength containing a stabilizer and having a thickness of 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of (a) a film-forming polymer of monomers including at least a major proportion of vinyl chloride, and (b) a substantially non-volatile plasticizing material therefor in an amount within the range of at least 1/3 the weight of said polymer but in a substantially lesser amount than said polymer and comprising at least a major proportion of a non-migrating viscous plasticizer resin, and the proportions being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contacting adhesive in the roll; (2) an adhesive primer coating on the inner face of the film backing adapted to increase the anchorage of the adhesive coating; and (3) a water-insoluble normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing, over said primer coating, said adhesive coating being thin in relation to said film backing; said film backing being in permanent equilibrium with said pressure-sensitive adhesive coating so as to avoid pastiness or loss of tack of said adhesive coating and diminution of the flexibility of said film backing; said adhesive tape being unwindable from the roll without delamination of the tape or offsetting of the adhesive, being originally stretchable in widths not greater than about one inch by simple hand-pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30%, as herein specified; said tape being readily conformable to irregular surfaces in insulating wire splices and its elasticity, retractability and high adhesion value making it easy, in insulated splices, to produce snug wrappings and coverings, and said tape having sufficiently aggressive adhesiveness to remain tightly and snugly wrapped around splices and wires."

fenses are (1) that the accused article does not infringe the claims of the patent because there was omitted from its composition one of the ingredients specified in the claims, and (2) that claims 6 to 9, which first appeared in the reissue, are invalid if construed to omit that element from the patented structure. The District Judge held all the claims valid and infringed.

The insulating tape manufactured by the plaintiff under the patent was a great improvement over prior insulating devices and met with much commercial success. The materials which entered into the composition of the new tape were well known. Vinyl resin, plasticizers and pressure-sensitive adhesives were all old. The problem was to plasticize the vinyl resin in the backing member so that the plasticizer would not migrate into the adhesive and impair its cohesive function, and so that portions of the plasticizer would not exude from the surface of the film upon the underlying adhesive layer when the tape was wound in a roll and cause a loss of tack. The inventors overcame these difficulties and produced a strong, stretchable and retractable article that furnished effective insulation in the splicing of electric wires and cables.

This result was accomplished by securing a permanent equilibrium between the vinyl backing and the adhesive by combining the ingredients in the manner described in the following excerpt from the specification of the patent:

> "In order to secure permanent equilibrium between backing and adhesive, we employ with the vinyl chloride polymer a combination of modifiers including a substantial but minor amount (not to exceed about 20 parts per 100 parts of the vinyl polymer) of a low molecular weight liquid plasticizer such as dioctyl phthalate, together with a substantially equal or somewhat greater amount of a high molecular weight resinous type plasticizer, the amount of the latter in

any event being sufficient, together with the liquid plasticizer, to provide the desired degree of stretch in the final film. "Paraplex G-25" is a preferred example of a suitable resinous type plasticizer. It is sold by Resinous Products & Chemicals Corp., and is a soft, viscous alkyd resin having a specific gravity of 1.06, and an acid number of not more than 2.0; it is soluble in esters, ketones, aromatic and chlorinated hydrocarbons. Another high-molecular-weight plasticizer material which has been found useful in providing suitably stretchable and elastic vinyl polymer films is polymerized ethyl acrylate. Another example is polymerized vinyl butyl ether.

"While resinous or high molecular weight modifiers such as "Paraplex G-25" are themselves capable of producing the desired degree of strength, stretch and elasticity in vinyl chloride polymer films, and furthermore are generally classed as "non-migrating" or "permanent" type modifiers or plasticizers, it is surprisingly found that these materials do not provide for permanent equilibrium of adhesive and backing as herein defined. Instead, it has been shown that pressure-sensitive adhesives in prolonged contact with highly stretchable and elastic films consisting solely of vinyl polymer and resinous modifier lose a great deal, if not all, of their initial tackiness or pressure-sensitivity. When tape made in this way is unwound from roll form, after a moderate period of storage, and applied to a splice, it does not adhere either to the electrical conductor or to its own backing, and hence is of no value as an insulating and protective coating."

Based on this disclosure, typical claim 1 of the patent clares that the patented tape is comprised of an elastic backing formed of a homogeneous mixture consisting a blend of (1) a major proportion of vinyl chloride, (2)

a substantially non-volatile liquid phytalyl ester plasticizer, (3) a soft and viscous low-acid-number alkyd plasticizer resin in amount at least equal to the amount of the liquid plasticizer, and (4) a pressure-sensitive rubber resin type adhesive coating united to the inner surface of the film backing.

Testimony bearing on the investigation and experiments which lead to the invention confirms the foregoing statement in the specification as to the ingredients of the product listed in claim 1. In 1938 or 1939, the plaintiff commenced its efforts to make a suitable adhesive plastic tape, using commercial vinyl (VYNS) with 25% to 40% of liquid tricresyl phosphate plasticizer, and a standard pressure-sensitive adhesive; but the experiment was unsuccessful, because the plasticizer migrated and made the adhesive very soft and pasty. In 1942 or 1943, Rohm and Haas, a widely known chemical company of Philadelphia, produced a new type of high-molecular-weight resinous plasticizer known as "Parapiex G-25", which could be combined satisfactorily with vinyl without causing migration. Early in 1944 plaintiff's research workers, to whom the patent in suit was subsequently issued, began to experiment with G-25 in combination with standard vinyl and standard adhesives from stock in an effort to make a satisfactory insulating tape. They found that G-25 did not migrate to the adhesive or soften it as the liquid plasticizer had done, but it did cause a loss of tack in the adhesive. Thus finding that neither the liquid nor resinous plasticizer when used alone gave satisfactory results, they tried a mixture of the two using a combination of dioctyl phthalate (DOP), a low-molecular-weight plasticizer, and G-25, a high-molecular-weight resinous plasticizer. This combination solved the difficulty and subsequently lead to the production and sale of the plaintiff's commercial article in 1945 and to the application for the original patent in 1946. The product speedily came into wide use and sales ad-

vanced from a little over $8000 during the year 1945 to more than $8,000,000 in 1953.[2]

The defendant, Plymouth Rubber Company, entered the field subsequently and began to experiment with adhesive vinyl plastic tape in 1948. It also had migration difficulties when it used the standard liquid plasticizer DOP and also found that G-25 was hard to disperse. Thereupon it experimented with G-40 as the sole plasticizer and found that it gave satisfactory results. Using it as the sole plasticizer the defendant produced a commercial article, which it put on the market in 1950 before the original patent was issued on July 10, 1951. The plasticizer G-40 was also manufactured by Rohm and Haas in 1945. It is a high-molecular-weight resinous plasticizer similar to G-25 but less expensive. It had also been used experimentally as the sole plasticizer by plaintiff's researchers, who reported that it was substantially equivalent to G-25 and caused a loss of tack but less loss than G-25. In 1946 or 1947, the plaintiff substituted G-40 for G-25 in the mixture with DOP in its commercial operations and this mixture became its standard commercial product.

In 1954, Plymouth found that by using a certain wax G-25 could be used successfully with vinyl as the sole plasticizer and prior to the institution of the pending suit made and sold such a product to the United States and, to some extent, to the general trade. In the complaint filed in the pending case, plaintiff charges infringement by the defendant by the use of both G-25 and G-40 as the sole plasticizer.

The facts so far related give substance to the main defense to the suit that the defendants did not infringe the

[2] As we have seen, claim 1 of the patent calls for a liquid plasticizer amounting to 8 to 20 parts per 100 parts of the film backing and a soft and viscous plasticizer resin in an amount at least equal to the amount of the liquid plasticizer. Claim 4 prescribes the use of 70 parts of vinyl, 10 parts of liquid plasticizer and 20 parts of resinous plasticizer.

patent because they omit from their production one element or ingredient, to wit, the liquid plasticizer, which is specified in the claims of the patent. It is well established that there is no infringement when this occurs even though the same result is obtained because the accused article is not covered by the claims of the patent. See **Vance v. Campbell**, 1 Black, 427, 429; **Acme Steel Co. v. Eastern Venetian Blind Co.**, 4 Cir., 227 F. 2d 914; **Anthony v. Sherman**, 4 Cir., 159 F. 2d 995; **Kaumagraph Co. v. Superior Trade Mark Mfg. Co.**, 2 Cir., 72 F. 2d 417; **Wichita Visible Gasoline Pump Co. v. Clear Vision Pump Co.**, 8 Cir., 19 F. 2d 435. This defense is not avoided by securing a reissue of a patent and omitting the disputed element from the claims unless the invention disclosed in the reissue is the very invention intended to be secured by the original patent. In **U. S. Industrial Chemicals Inc. v. Carbide Carbon Chemicals Corp.**, 315 U. S. 668, the patent before the Court related to the production of ethylene oxide by bringing ethylene and oxygen in the reaction chamber in the presence of a catalyzer and of water as an essential. The Court held that a reissue of the patent, which treated the introduction of water as permissive but not mandatory, was void since it was not for the same invention described and intended to be secured by the original patent. The Court said, pp. 675-676:

> "The question is whether, in the light of the disclosures contained in the two patents, they are for the same invention. This court has said that they are if the reissue fully describes and claims the very invention intended to be secured by the original patent; if the reissue describes and claims only those things which were embraced in the invention intended to have been secured by the original patent; if the broader claims in the reissue are not merely suggested or indicated in the original specification but constitute parts or portions of the invention which were intended or

sought to be covered or secured by the original patent. The required intention does not appear if the additional matter covered by the claims of the reissue is not disclosed in the original patent. If there be failure of disclosure in the original patent of matter claimed in the reissue, it will not aid the patentee that the new matter covered by the reissue was within his knowledge when he applied for his original patent. And it is not enough that an invention might have been claimed in the original patent because it was suggested or indicated in the specification. It must appear from the face of the instrument that what is covered by the reissue was intended to have been covered and secured by the original."

The plaintiff in its reply does not challenge the established doctrine that a product patent is not infringed by an article which omits one of the elements of the patented structure, but advances the counter-contention that the defendants have misinterpreted the teaching of the patent. It is now said that the patent discloses that the insulating tape, in addition to the vinyl and the adhesive, may be made either with a blend of liquid and resinous plasticizers or simply with a resinous plasticizer alone which combines within itself both light and heavy molecules; and that claims 1 to 5 of the patent cover a tape of the first sort while claims 6 to 9 cover a tape in which only a resinous plasticizer is used. This view is based largely upon certain statements in the specification that polymerized ethyl acrylate "has been found useful in providing suitable, stretchable and elastic vinyl polymer films." The evidence shows that this substance described in the specification as "another high-molecular-weight plasticizer material" also contains molecules of relatively low weight; and the Judge found that "the patent in suit teaches persons skilled in the art that ethyl acrylate polymer may be used as the plasticizer for the film backing of the tape of the patent."

The plaintiff's expert, Tierney[3], produced at the trial below a sample of tape made under his direction in which ethyl acrylate polymer was the sole plasticizer, and according to his testimony gave satisfactory results.

These references, however, do not support the plaintiff's contention or the Judge's finding. The specification does not show that ethyl acrylate polymer may be used as the sole plasticizer but, to the contrary, clearly teaches that it is to be used in place of the resinous plasticizer called for by the patent. The specification expressly states that "Paraplex G-25 is a preferred example of a suitable resinous type plasticizer" and then declares in the phrase above quoted that ethyl acrylate polymer is another high-molecular-weight plasticizer which has been found useful. Later in the specification ethyl acrylate polymer is again referred to as a high-molecular-weight plasticizer which "may be substituted in whole or in part for the specific alkyd resin hereinbefore mentioned"; and G-25 is described in the specification "as a soft viscous alkyd resin." Reading only these portions of the specification referring to ethyl acrylate polymer demonstrates the frailty of the plaintiff's contention and combining them with the emphatic assertion above quoted that both types of plasticizers must be used to give good results shows beyond question that the finding was clearly erroneous.[4]

---

[3] Hubert James Tierney was chief chemist of the plaintiff company from 1934 to 1943, Tape Products manager from 1932 to 1948, manufacturing manager of the Tape Division of the company from 1948 until 1952, and since that time he has been vice president of the company in charge of Tape Research and Tape Manufacturing. He supervised the research by the inventors of the patent in suit during the experimental period.

[4] The following statement was made by the inventors during the progress of their application through the Patent Office, in order to distinguish their discovery from an earlier patent to Robertson. Referring to this patent they said:

"There is no suggestion of the three-way blend used by applicants, employing the vinyl chloride polymer, the liquid phthalyl

If Tierney, during the experimental period, had succeeded in making an insulating tape with a single plasticizer, the product doubtless would have been the basis for a patent claim, but it was "surprisingly found" that this could not be done. It is not sufficient for a patent to suggest a field for further experimentation; to be valid it must itself disclose the essential elements of the discovery so that persons skilled in the art may practice it (See U. S. C. § 1012; **Consolidated Electric Light Co. v. McKeesport Light Co.**, 159 U. S. 465; **Standard Brands v. National Grain Yeast Corp.**, 3 Cir., 101 F. 2d 814, affirmed, 308 U. S. 34. It follows that the scope of the patent in suit is limited by its disclosure and may not be extended to cover what other investigators subsequently discovered.

In addition to the references to ethyl acrylate polymer in the specification, the fact is stressed that a resinous plasticizer is comprised of light as well as heavy molecules; and the plaintiff strongly contends that these components may be so put together that the finished product will contain a liquid as well as a resinous element and thus constitute an equivalent of the blend of two kinds of plasticizers prescribed by the patent; and it is asserted that G-25 and G-40 are plasticizers of this sort and hence their use by the defendants constitutes infringement. The defendants concede that the use of a pre-blended mixture would be equivalent to mixing the two plasticizers during the process

ester, and the alkyl resin, combined together. That this three-way blend is essential to the success of applicants' product was clearly pointed out in the application as filed. Thus on page 2 it was pointed out that the phthalate plasticizer used alone resulted in inadequate stretch and elasticity, particularly in respect to backings of the thickness used in electrical tapes. If the plasticizer proportion is increased, the film becomes unstable because it makes the adhesive become soft and pasty. On the other hand, the resinous type plasticizer, if used alone in sufficient amount to impart desirable physical properties, results in the adhesive losing its tack (top of page 5). Obviously this Robertson patent does not teach applicants' discovery—first because it does not disclose their backing film, and second because it teaches nothing about the problems of pressure-sensitive tape backings."

of production. Hence the crucial inquiry is whether G-25 and G-40 actually contain a liquid as well as a resinous element.

It will be noticed that during the experimental period the patentees tried both G-25 and G-40 as a sole plasticizer and failed, but that later the defendants found that either could successfully be used alone. The plaintiff claims, however, that after 1944 the composition of G-25 was changed and that it now contains both liquid and resinous portions. In this respect the Judge made the specific finding that "Paraplex G-25, when the applicants for the patent worked with it in 1944 and 1945, was substantially different than it is today," and he added that in this earlier period the substance was in the process of development of manufacture, and that today G-25 and other polymerized plasticizers can be "tailored" to get the results which users desire. This change, the Judge suggested, explains the failure of the inventors in 1944 and the failure of Plymouth in 1948-50 to make the tape with G-25 as the sole plasticizer.

The Judge made the additional finding that by certain processes resinous plasticizers may be "fractionated" into the more viscous high-molecular-weight portions and the more liquid low-molecular-weight portions of the original materials[5]. Hence, the plaintiff contends that infringement has been established by the use of a resinous plasticizer alone notwithstanding the seeming teaching of the patent to the contrary.

---

[5] According to the testimony of Tierney, G-40 when fractionated was found to contain 67% of the more viscous high-molecular-weight resinous portion and 33% of the more liquid lower-molecular-weight portion; G-25, 88% and 12%; ethyl acrylate polymer, 72% and 28%. The fractionation was done under Tierney's direction by a chemist who was not produced as a witness. The chemist was given no standard to follow in what should be considered the liquid and what should be the resinous portion of the fractionated material. The liquid portions produced was much more viscous than the plasticizers, such as DOP, which are known to the art as liquid plasticizers.

Our examination of the record convinces us that the findings on which this conclusion is largely based are not in accord with the great weight of the evidence. It is argued that there must have been a great change in the composition of G-25 as manufactured by Rohm and Haas because the plaintiff could not use it successfully as the sole plasticizer in 1944 and 1945, but can do so today. No comparison was offered by the plaintiff of the ingredients of the substance in the respective periods, with one exception: that in 1944 and 1945, G-25 had a film of oil on the surface of the containers whereas no oil is observable in the plasticizer supplied by Rohm and Haas to the plaintiff today. There was, however, no direct testimony that the film of oil affected the manufactured article adversely—the only evidence on the point being that of the defendants' expert, that the oil would be more helpful than otherwise. Moreover, the plaintiff was unable to make the tape in 1944-45 with G-25 of its own manufacture which bore no oil film on the surface, or with G-40, as to which there is no evidence or finding of change. It is of far greater importance to note that there is positive and direct testimony on the part of Rohm and Haas, who supplied G-25 and G-40 to both parties in the pending case, that there has been no significant change in G-25 since it was first put on the market[6].

---

[6] In response to an inquiry, Rohm and Haas made the following statements in the course of their letter of December 20, 1954, addressed to both parties in the pending case:

". . . We normally prefer not to disclose details on the composition of our products, but we recognize that in view of the granting of this patent our customers will require considerable information on the PARAPLEX plasticizers and the differences that exist between them. We have accordingly prepared the following description of these products. We believe this description provides all the information concerning them needed for the resolution of questions arising out of the reissue patent."

[Here follows a description of the constituents of these materials.]

"PARAPLEXes G-25, G-40, G-50 and G-53 are all linear polyesters of aliphatic dicarboxylic acids and glycols. . . . These four

We reject also the contention that the patent teaches that the more liquid low-molecular-weight portions of a resinous plasticizer are the equivalent of a liquid plasticizer, such as DOP, which, according to the patent, must be used to secure a satisfactory insulating adhesive tape. The record does not support this thesis. The evidence clearly shows that there are two well defined and distinctive types of plasticizers, as the language of the specification indicates, which are not only well recognized by the trade but are characterized by substantial differences in chemical composition. The liquid plasticizers are all monomeric, that is, they are simple, precise and well defined chemical compounds of low-molecular weight ranging from 250 to 600. In them every molecule is like every other molecule so that the material cannot be fractionated. It is thinly fluid. DOP for example, has a molecular weight of 390 and a viscosity of less than one poise, which is the unit by which viscosities are measured. Resinous plasticizers on the other hand are polymeric. They are synthetic compositions made by combining chemicals of high-molecular-weight and are extremely viscous. G-25, for example, has a viscosity of 1000 poises. The molecules of these resins are combinations of varying numbers of so-called building units and accordingly vary in weight, ranging in the case of G-25 from 1,000 to 50,000. Its average molecular weight is 8000. It is substantially correct to say that no part of G-25 is liquid and no part of DOP is resinous, as these terms are known to the art. Tierney himself used the terms "liquid" and "resinous" as indicative of distinct

---

Polyesters also differ in number average molecular weight as follows:

PARAPLEX G-25—8000
PARAPLEX G-40—6000
PARAPLEX G-50—2200
PARAPLEX G-53—3380

"In each of these products no significant change has been made since it was first offered for sale."

classes of plasticizers and testified that all portions of G-25 are resinous.

It may be that the lower weight molecules in the resinous plasticizers perform the function which the patent attributes to the liquid plasticizers in making the finished product with the result that both parties in the pending case now find that G-25 or G-40 may be used as the only plasticizer; but it is certain that the inventors were unaware of this fact and maintained the contrary positions. On this account the patent does not cover the defendants' product and infringement is not proved. Even if it be supposed that the composition of G-25 has been so changed as to contain a larger number of molecules of relatively low weight than the G-25 produced during the experimental period, and that by reason of this change it is now possible to use resinous material as a sole plasticizer, its use in making an insulating tape would not constitute infringement, because the plasticizer would still be completely resinous whereas the patent teaches that a liquid as well as a resinous plasticizer must be used.

Little need be said about claim 6 of the reissued patent. It provides for the use of a plasticizer "comprising at least a major proportion of non-migrating viscous plasticizer resin". If this dubious phrase means that only a resinous plasticizer need be used, the claim is invalid because it goes beyond the disclosure of the original patent; if, on the other hand, the phrase means that both liquid and resinous plasticizers are to be used, the claim is not infringed by the defendants.

Reversed and remanded.

JUDGMENT OF THE COURT OF APPEALS.

(April 1, 1957.)

Appeal from the United States District Court for the Middle District of North Carolina.

This cause came on to be heard on the record from the United States District Court for the Middle District of North Carolina, and was argued by counsel.

On consideration whereof, it is now here ordered, adjudged and decreed by this Court that the decree of the said District Court appealed from, in this cause, be, and the same is hereby, reversed with costs; and that this cause be, and the same is hereby, remanded to the United States District Court for the Middle District of North Carolina, at Greensboro, for further proceedings not inconsistent with the opinion of the Court filed herein, April 1, 1957.

Morris A. Soper,
United States Circuit Judge.

OPINION OF THE COURT OF APPEALS ON MOTION TO REOPEN AND PETITION FOR REHEARING.

(October 18, 1957.)

PER CURIAM:

After our decision in this case, **Sears, Roebuck and Co. and The Plymouth Rubber Co. v. Minnesota Mining and Manufacturing Co.**, 243 F. 2d 136, in which United States Reissue Patent No. 23,843 was held not to be infringed by the defendant, a petition for rehearing and a motion to reopen the case on the ground of newly discovered evidence were filed. The decision of the Court was based in large part upon the teaching of the patent that, in order to manufacture the patented adhesive insulating tape, it was necessary to use both a resinous or high molecular weight modifier, such as Paraplex G-25, but also a low molecular weight liquid plasticizer such as dioctyl phthalate. The evidence showed that in the manufacture of the infringing article the liquid plasticizer was omitted and only G-40, a resinous plasticizer substantially similar to G-25, was employed; and it was further shown at the trial that there had been no significant change in either G-25 or G-40 since these materials were first offered for sale.

It is now asserted that the newly discovered evidence will show that in fact G-25 has been substantially changed and is now different from that which was in use at the time of the invention, in that the present day article contains a larger proportion of small molecular weights. Hence it is contended that the infringing article is equivalent to the patented article, which contains both resinous and liquid plasticizers.

There is conflict in the evidence as to whether the plaintiff used due diligence at the time of the trial in procuring samples of G-25 which were then obtainable and showing

the composition of the present day article at that time. Assuming, however, that there was no lack of due diligence, the motion to reopen the case for the taking of additional evidence must be overruled, because even if the new evidence should demonstrate the alleged change in the composition of G-25, the decision of the Court would necessarily be retained. This is so because G-25, although changed to contain a larger quantity of low molecular weights, would nevertheless be a resinous plasticizer and would not be composed partly of a resinous and partly of a liquid plasticizer in accordance with the teaching of the patent. It is obvious from the record in this case that the defendant's successful operation was due to further research and not the teachings of the patent. As was said in the opinion of this Court: "It is not sufficient for a patent to suggest a field of further experimentation; to be valid it must itself disclose the essential elements of the discovery so that persons skilled in the art may practice it."

The futility of granting the motion for the taking of newly discovered evidence is also apparent from the fact that the Court in its opinion has already considered the possibility which the motion now presents. It was disposed of in the following words: "Even if it be supposed that the composition of G-25 has been so changed as to contain a larger number of molecules of relatively low weight than the G-25 produced during the experimental period, and that by reason of this change it is now possible to use resinous material as a sole plasticizer, its use in making an insulating tape would not constitute infringement, because the plasticizer would still be completely resinous whereas the patent teaches that a liquid as well as a resinous plasticizer must be used."

It is argued that there is infringement of Claims 6, 7, 8 and 9, which are new in the reissue patent, on the ground that they do not call for a liquid plasticizer. But, as pointed

out in our original opinion, these claims are vague with respect to the plasticizers to be used, for they merely provide for the use of a plasticizer "comprising at least a major proportion of non-migrating viscous plasticizer resin." If these claims are taken to mean that a liquid plasticizer is not used, they are void because not supported by the teachings of the original patent. Not only did the claims of that patent call for a liquid as well as a resinous plasticizer, but the teaching of the specification was that the use of the liquid plasticizer was essential and that the use of a resinous plasticizer alone would not produce satisfactory results. All of the claims of the reissued patent, whether old or new, must be construed in the light of this teaching and if the added claims are interpreted as excluding the use of a liquid plasticizer, the patent would be enlarged in scope and therefore void. See **U. S. Industrial Chemicals, Inc. v. Carbide and Carbon Chemicals**, 315 U. S. 668, 678, where it was said:

> "It is inadmissible to enlarge the scope of the original patent by recourse to expert testimony to the effect that a process described and claimed in the reissue, different from that described and claimed in the original patent, is, because equally efficacious, in substance that claimed originally. If such testimony could tip the scales on the issue of the validity of a reissue, it would always be possible to substitute any new combination of steps or elements or devices for the one originally described and claimed by proving that the omission of any one or more steps would not alter the result.
>
> "This court has uniformly held that the omission from a reissue patent of one of the steps or elements prescribed in the original, thus broadening the claims to cover a new and different combination, renders the reissue void, even though the result attained is the same as that brought about by following the process claimed in the original patent."

For like reason, it cannot be held that under the doctrine of equivalents, the original patent is infringed. Without going into the question as to whether in the case of a combination patent what is claimed to be an equivalent must have been recognized as such at the time of the granting of the patent,* the doctrine of equivalents has no application where one of the elements called for is entirely omitted.

The petition for rehearing presents no questions that were not fully considered in the prior opinion of the Court. Accordingly, the petition for rehearing and the motion to reopen the case will both be denied.

ORDER DENYING MOTION TO REOPEN AND PETITION FOR REHEARING.

(October 18, 1957.)

On consideration of the petition of the appellee for a rehearing in the above-entitled case; and the motion of appellee to reopen the case on the ground of newly discovered evidence, and argument thereon:

It is, for reasons set forth in the opinion filed herewith, ordered by this Court that the petition for rehearing and the motion to reopen the case be, and both are hereby, denied.

October 18, 1957.

Morris A. Soper,
United States Circuit Judge.

---

* *See Graver Mfg. Co. v. Linde Co.*, 339 U. S. 605, 609; *Halliburton Oil Well Cementing Co. v. Walker*, 329 U. S. 1, 13; *Fuller v. Yentzer*, 94 U. S. 288, 294-297; *Gill v. Wells*, 22 Wall. 1, 24; *Gould v. Rees*, 15 Wall. 187; *Seymour v. Osborne*, 11 Wall. 516; 40 Am. Jur., p. 650; 69 C. J. S., p. 870; *Cf. Technical Tape Corp. v. Minnesota Mining & Mfg. Corp.*, 2 Cir., ... F. 2d ...; *Finkelstein v. Kress*, 2 Cir., 113 F. 2d 131.

OPINION OF THE DISTRICT COURT.

(June 4, 1956.)

Hayes, District Judge:

This infringement suit is brought by the assignee of a patent on a pressure-sensitive stretchable and retractable vinyl plastic tape primarily for use as an electrical insulating tape. The original application was filed by Oace, Snell and Eastwold January 12, 1946, and Patent 2559990 issued July 10, 1951, naming them as assignors to the Minnesota Mining and Manufacturing Co. For convenience it will be referred to as the Oace Patent. Also involved is Reissue patent 23,843 of June 29, 1954, on application filed July 9, 1952. All available defenses are asserted.

Prior to the Oace invention, great difficulties with conventional methods of splicing electric conductors had been encountered, among others, the bulky and cumbersome and time consuming element in making splices; the materials available were ineffective under temperature changes of heat and moisture; the loss of tackiness (adhesiveness) and by becoming soft and pasty, resulting, in the tape then in use, in loosening and becoming ineffective. Slight increase in temperature above normal room temperature increased this tendency to impair the effectiveness of the splicing material with the consequent grave hazards of escaping voltage.

The Oace invention overcame these and other defects by providing an insulated spliced electrical conductor which is "electrically, mechanically and chemically effective" and is readily and quickly prepared without use of special procedures or equipment. These results are obtained by the use of an insulating tape in the form of a

relatively thick but easily stretchable and highly elastic pressure-sensitive adhesive tape comprising a well-bonded, water-insoluble, non-corrosive, normally Tacky and pressure-sensitive adhesive coating on a plasticized vinyl chloride polymer film which is in permanent equilibrium with the adhesive; it neither softens nor loses its adhering qualities on prolonged contact with the backing or film layer.

Oace found that high molecular weight modifier such as "Paraplex G-25," would produce the desired strength, stretch and elasticity in vinyl chloride polymer films, though classed as "non-migrating" or "permanent" plasticizers, failed to provide for permanent equilibrium of adhesive and backing. When tape made in that manner was unwound from the roll, after a moderate period of storage it would not adhere either to the electrical conductor or to its own backing, and was of no value as an insulating and protective coating. Oace provided an electrical insulating tape having stretch and elasticity rendering it highly effective for wrapping wire and cable splices.

It was stretchable to the extent of 50% at room temperature, by mere pulling with the hands; it could be stretched 30% at room temperature and would retract to substantially its original length. He discovered how to overcome moisture and temperature destruction and to prevent loss of adhesiveness due to migration. He gave examples of insulating tapes in the form of pressure-sensitive adhesive tapes having a vinyl polymer film base were prepared with a vinyl chloride vinyl acetate Copolymer softening at about 280 degrees F. and in the ratio of vinyl chloride to vinyl acetate of approximately 89:11. After giving many examples, he finds that the plasticizer must be compatible with the Vinyl polymer, and must be sufficiently low in Volitility so that it is not driven off during milling and calendering, or during subsequent storage and use.

After citing five examples of the various embodiments of his invention, for purposes of illustration rather than limitation, he makes the five claims set out in the margin.[1]

---

[1] 1. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprised of: a stretchable and elastic film backing having a thickness of 4 to 20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of a film-forming polymer of monomers including at least a major proportion of vinyl chloride, a substantially non-volatile liquid phthalyl ester plasticizer amounting to 8 to 20 parts per 100 parts of said polymer, and a soft and viscous low-acid-number alkyd plasticizer resin in amount at least equal to the amount of said liquid phthalyl ester plasticizer, the total amount of said plasticizers being about 1/3 to 1/2 the amount of said polymer and the proportions being such that the adhesive tape has the properties of stretch and elasticity hereafter specified without causing pastiness or tack-loss of the contacting adhesive in the roll; and a cohesive normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing; said adhesive tape being unwindable without delamination or offsetting of adhesive, being originally stretchable by hand-pulling to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30% as herein specified.

2. An adhesive tape according to claim 1, wherein the adhesive includes a small proportion of an oil-soluble heat-reactive phenol-aldehyde resin.

3. An adhesive tape according to claim 1 in which the film forming polymer is a copolymer of vinyl chloride and a minor proportion of vinyl acetate, said copolymer having a softening temperature of at least about 280 degrees C.

4. A pressure sensitive adhesive insulating tape wound upon itself in roll form and comprised of: (1) a stretchable and elastic film backing having a thickness of 4 to 10 mils and formed of a homogeneous mixture primarily consisting of a stable blend of 70 parts of copolymer of vinyl chloride and a minor proportion of vinyl acetate, about 10 parts of a substantially non-volatile liquid phthalyl ester plasticizer, and about 20 parts of a soft and viscous low-acid-number alkyd plasticizer resin; (2) an adhesive primer coating on the inside face of the film backing adapted to increase the anchorage of the adhesive coating; and (3) a cohesive normally tacky and pressure-sensitive rubber-resin type adhesive coating bonded to said primer coating; said adhesive tape being unwindable without delamination or offsetting of adhesive, being originally stretchable to an extent of at least 100% at room tem-

The reissue copies all contained in the original patent, and adds claims 6, 7, 8 and 9 to the five of original patent. Claim 6 typical of the others, is cited in the margin.[2]

The specification of the reissue is the same as the original patent except comment on the novelty of the tape and

---

perature and being substantially completely retractable from an elongation of 30% as herein specified.

5. An adhesive tape according to claim 4, wherein the adhesive includes a small proportion of an oil-soluble heat-reactive phenol-aldehyde resin.

[2] 6. A pressure-sensitive adhesive insulating tape wound upon itself in roll form and comprising: (1) a water-insoluble and hydrocarbon-oil-insoluble film backing of high dielectric strength containing a stabilizer and having a thickness of 4-20 mils and formed of a homogeneous mixture primarily consisting of a stable blend of (a) a film-forming polymer of monomers including at least a major proportion of vinyl chloride, and (b) a substantially non-volatile plasticizing material therefor in an amount within the range of at least 1/3 the weight of said polymer but in a substantially lesser amount than said polymer and comprising at least a major proportion of a non-migrating viscous plasticizer resin, and the proportions being such that the adhesive tape has the properties of stretch, elasticity and retractability hereafter specified without causing pastiness or loss of the tack of the contacting adhesive in the roll; (2) an adhesive primer coating on the inner face of the film backing adapted to increase the anchorage of the adhesive coating; and (3) a water-insoluble normally tacky and pressure-sensitive rubber-resin type adhesive coating united to the inner face of said film backing, over said primer coating, said adhesive coating being firm in relation to said film backing; said film backing being in permanent equilibrium with said pressure-sensitive adhesive coating so as to avoid pastiness or loss of tack of the said adhesive coating and diminution of the flexibility of said film backing; said adhesive tape being unwindable from the roll without delamination of the tape or offsetting of the adhesive, being originally stretchable in widths not greater than about one inch by simple hand pulling, exercising a force of not more than about 10 to 15 pounds, to an extent of at least 50% at room temperature and being substantially completely retractable from an elongation of 30% as herein specified; said tape being readily conformable to irregular surfaces of insulating wire splices and its elasticity, retractability and high adhesion value making it easy, in insulated splices, to produce snug wrappings and coverings, and said tape having sufficiently aggressive adhesiveness to remain tightly and snugly wrapped around splices and wires.

definition of terms. There are no additional disclosures of a tape or how to make it. The claims of the reissue appear to embody nothing not disclosed in the original application and invention and they do not broaden the disclosures of the original patent but are further descriptive or illustrative of the teachings of the original patent. The recent case in the Fourth Circuit of Florence-Mayo Nuway Co. v. Hardy, 168 F. 2d 778, appears to state the principles of law applicable to the instant case. Applying the principles of law so ably stated by Judge Parker in Colgate-Palmolive Co. v. Carter Products, Inc., 230 F. 2d 855, to the facts in this case, we conclude that the patent is valid. The instant case and the Palmolive case above are not in conflict with the opinion in Sinclair Co. v. Inter Chemical Corp., 325 U. S. 327.

Much of the controversy here arises from the employment of Paraplex G-25 as one of the ingredients in the production of the tape by the plaintiff and by the defendants in the accused tapes.

It is perfectly clear that the Paraplex G-25, when the application for the original patent was filed, was of a substantially different formula than that of its later or subsequenf vintage. This old formula of Par. G-25, in part, accounted for the defects of the tape which became manifest from the exposure, change of moisture or temperature or from storage. The problem was to discover what to do to solve these difficulties. Once discovered and taught how Paraplex G-25 could not be used alone but the combinations with which it would add to the equilibrium of the tape and vastly prolong its usefulness and efficiency, and how to eliminate migration. The evidence abundantly shows that the subsequent vintage of Paraplex G-25 was altered and tailored so that, in a large measure, it overcame the migration. But the alteration of Paraplex G-25 * * * which in its new vintage included the old vintage of

Paraplex G-25 and the chemical product which plaintiffs discovered necessary to use in combination to solve the problem does not invalidate the patent or excuse the defendants from infringement.

If it be granted that there was a novelty in the chemical combination which resulted in a non-migrating adhesive tape which was resistant to changes of heat and moisture and storage, and if we conclude, as the evidence shows, that such a solution was discovered by using dioctyl phthalate or other plasticizer compatible with vinyl polymer and with a definite ratio which was sufficiently low in volatility so that it was not driven off during milling, storage or from exposure; and the desired film could be produced from a mixture of 700 parts of Vinylite VYNS, 200 parts of Paraplex G-25, 100 parts of dioctyl phthalate and 25 parts calcium stearate milled together and calendered to a thickness of 4 mils; to which was added a primer made of 985 lbs. of an ammoniacal casein with 624 lbs. of an aqueous dispersion containing 38% by weight of a copolymer of 50 parts butadiene and 50 parts styrene, after drying resulted in an extremely thin primer film; then add to the primed film the mixture of properly apportioned elements constituting the pressure-sensitive adhesive, the three elements—film, primer and adhesive—, resulting in the new combination for making the desired tape as is taught in the Otce patent, then it is obvious that a subsequent alteration of some of these elements, for example, by including two of them into one element, and thereafter using the result, could not invalidate the patent nor successfully avoid infringement. Judge L. Hand, in Royal Typewriter Co. v. Remington Rand, 2d Cir., 168 F. (2d) 691, 693, tersely stated the principle in these words: "Courts have with curious unanimity held that it does not avoid infringement to combine into one member that which the patent discloses as two if the single member performs the duties of both in the same way."

The accused tapes clairly infringe claims 1 of the original patent and 6 of the Reissue. Not only are the accused tapes the equivalent of the tape embodied in the above claims but they are practically identical in result. Moreover, they actually embody the very chemical equivalents taught in both the original patent and in the reissue. It is significant that Plymouth discounted the value and marketability of plaintiff's product until it became the leader in the electric tape field. Plymouth's salesman discovered this and afterwards Plymouth came out with the accused tapes. In August, 1947, General Electric, speaking of #33 Scotch electrical tape (under Oace patent), said: "For the first time in fifty years a revolutionary electrical tape is on the market ready for immediate delivery."

The commercial success of the patented tape was phenominal. In 1945 the sales were $8,270.19; in 1946, $94,000.00; in 1948, $1,500,000 and in 1953 reached $8,712,744.75. When Plymouth copied Oace patent, its sales jumped rapidly to $400,000.00 in 1952 and $500,000.00 in 1953. In 1950 and 1951, Plymouth's output was so small it did not bother to get the figures.

A decree will be entered permanently enjoining each defendant from further infringement and appointing Rufus Reynolds, Esq., to ascertain the damages.

PERTINENT FINDINGS OF FACT OF THE DISTRICT COURT.

29. The subject matter of the Oace et al. patent in suit is an electrical insulating tape in the form of a relatively thin (about 4 to 20 mils) backing film, which is easily stretchable (by simple hand pulling) and readily retraceable, combined with a well bonded water-insoluble, normally tacky and pressure-sensitive adhesive coating, the backing film being formed from a plasticized vinyl chloride polymer which is in permanent equilibrium with the adhesive coating in order that the adhesive will not soften (become pasty) or lose tack (become non-adherent), thereby providing an insulating tape that may be wound in a roll and unwound therefrom without delamination of the tape or offsetting of the adhesive.

30. The central problem to which the patent in suit is addressed, and which is solved, was to provide an insulating tape in the form of an easily stretchable and highly elastic pressure-sensitve adhesive tape comprising a well-bonded, water-insoluble, non-corrosive, normally tacky and pressure-sensitive coating on a plasticized vinyl chloride polymer film which is in permanent equilibrium with the adhesive.

31. The patent in suit teaches persons skilled in the art that ethyl acrylate polymer may be used as the plasticizer for the film backing of the tape of the patent. The patent discloses a plasticizing system which is satisfied by one or more ingredients of plasticizing material. There is in evidence a roll of pressure-sensitive insulating tape wherein the film backing is 100 parts of VYNS vinyl chloride copolymer resin plasticized with 50 parts by weight of ethyl acrylate polymer resin.

32. The Oace reissue specification introduced no new matter over the specification of the original Oace patent.

The only changes in the reissue patent specification from the specification of the original patent are the italicized portions appearing in columns 1, 8 and 9. None of the added portions makes a new disclosure of invention but rather are merely further discussions of the advantages claimed for this type of tape, or definitions.

33. Each of the claims in suit particularly points out and distinctly claims the invention disclosed in the patent in suit.

34. The reissue patent is for the same invention as the original patent. There is no change in disclosure; and the claims of the reissue comprehend no more than the inventors disclosed and intended to cover originally.

35. The original Oace patent was partly inoperative clearly and distinctly to cover, in literal terms, the inventions disclosed therein and intended to be claimed. This defect arose through error, and without any deceptive intention.

36. Lack of patent experience on the part of the applicants (Oace et al), and lack of understanding of the invention on the part of their patent solicitors constituted error justifying the Patent Office in its grant of the clarifying reissue.

37. Plasticization and migration are both physical phenomena.

38. Paraplex G-25 and Paraplex G-40 are respectively the polymerized reaction products of sebacic and adipic acid with a dihydric alcohol; and each is a soft, viscous linear polyester alkyd plasticizer resin.

39. In the process of polymerization, the composition of the resultant product depends upon the conditions of the polymerization, for example, time, temperature, the catalyst employed, and other factors, so that different types of polymers can be produced as desired.

40. Paraplex G-25 and Paraplex G-40 are represented by the manufacturer thereof to be "tailor-made", and to combine to a marked degree many of the desirable features of the more liquid ester-type plasticizers, such as dioctyl phthalate, with those features obtainable in resinous plasticizers.

41. Paraplex G-25 is represented by its manufacturer to be "a soft, tacky, viscous liquid which pours slowly at room temperature". Paraplex G-40 has even a lower viscosity than Paraplex G-25 at "slightly elevated temperatures".

42. Polyester plasticizers for vinyl chloride copolymers, such as Paraplex G-25 and Paraplex G-40 made by Rohm & Haas, may be fractionated by known procedures, but not by distillation, into the more viscous higher-molecular-weight portions and the more liquid lower-molecular-weight portions of the original material.

43. The more liquid portion of Paraplex G-40 is a liquid adipyl ester plasticizer. Both adipyl ester plasticizers and phthalyl ester plasticizers are plasticizers for vinyl chloride polymers; both are esters of organic carboxylic acids; both are liquid; and both are non-volatile.

44. Sebacic, adipic and phthalic acid esters are available as liquid plasticizers for vinyl chloride polymers, offered in commerce, and referred to in the literature in the same grouping; and all function by physical action in the same way to produce soft, pliable, stretchable and elastic polyvinyl chloride film.

45. When the lower-molecular-weight fraction of Paraplex G-40 is blended with the more viscous higher-molecular-weight portion, a plasticizer is obtained which, by physical action in combination with vinyl chloride polymers, functions in the same way to give essentially the same results as the combination of Paraplex G-25 and dioctyl phthalate in the ration of 2 to 1.

46. The more liquid lower-molecular-weight portion of Paraplex G-40 constitutes about 33% thereof. This portion is a liquid adipyl ester plasticizer; and is the equivalent of a liquid phthalyl ester plasticizer. The ratio of two parts of higher-molecular-weight viscous resinous plasticizer to one part of more liquid lower-molecular-weight plasticizer found in Paraplex G-40 is within the recommended range of examples of the Oace patent. The use of Paraplex G-40 as the plasticizing material in the accused Plymouth tapes produces the same results in the same way by the same or equivalent means as the examples of the patent in suit.

47. A person skilled in the art can produce the tape as disclosed by the Oace patent by following the teachings of the patent. Plaintiff's commercial tape is made in accordance with the teachings of the patent. The accused tape was not derived from the prior art; rather it was produced by Plymouth and Technical Tape, respectively, essentially by duplicating plaintiff's commercial tape.

48. The purpose of vacuum stripping during the manufacture of Paraplex G-25 and Paraplex G-40 by Rohm & Haas is to remove free glycol and water which may result from the poly-esterification, and does not remove ester material of the order of 300, 400 or 500 molecular weight. The building unit, or monomer, of both G-25 and G-40 has a molecular weight falling within the range of about 300-350.

49. Paraplex G-25, when the applicants for the patent in suit worked with it in 1944 and 1945, was significantly different than it is today.

A. The attempt of Oace et al. in 1944 to make their tape with Paraplex G-25 as the sole plasticizer led to a tape which was unsuccessful and quickly lost its tack.

B. Danovitch of Plymouth could not make tape with G-25 as the sole plasticizer in the period from 1948-1950.

C. In late 1943 and 1944, Paraplex G-25 was in the process of development for manufacture on both a pilot-plant and plant scale. Its composition by that time had been defined research-wise "at least in respect to its major features". The first production batch of Paraplex G-25 was not made until early 1944.

D. In the production of Paraplex G-25 in recent years, Rohm & Haas, the manufacturer, has held the product to narrower specifications.

E. Paraplex G-25, like other polymerized plasticizers, can be tailored by process controls, and is so tailored, to get desired results to meet customers' demands.

F. Paraplex G-25 of recent vintage as the sole plasticizer will make suitable tape today, although still not as good as when some additional low molecular weight plasticizer is used.

G. Paraplex G-25 of 1944 and 1945 vintage had an oil film on its surface in the containers; recent vintage Paraplex G-25 does not have an oil film

H. Paraplex G-25 is not a chemically-pure compound, even today.

50. The use of Paraplex G-25 of recent vintage as the plasticizer material in the film backing makes a tape of satisfactory aging life, fully responsive to the disclosure of the patent, although there is a relatively low amount of tack loss. The quality of such tape is improved when a small amount of a more liquid plasticizer, such as dioctyl phthalate, is added to the plasticizer material.

51. The more liquid lower-molecular-weight portion of the recent vintage Paraplex G-25 constitutes about 11% thereof. This portion is a liquid sebacyl ester plasticizer. The ratio of about 8 or 9 parts of higher-molecular-weight viscous alkyd resin plasticizer to about 1 part of more liquid

lower-molecular-weight plasticizer found in this Paraplex G-25 is within the compass and scope of the Oace patent. The use of Paraplex G-25 as the plasticizing material in the accused Plymouth tapes produces the same results in the same way by the same or equivalent means as the examples of the patent in suit.

52. The plasticizing materials herein found to be full equivalents for those specifically recited ingredients disclosed in the patent in suit are either tailor-made for the purpose or are normal, well-known substitution products for the material specified in the patent, and which would be used by persons skilled in the art without experimentation.

53. The accused Plymouth Plastic Electrical Tape which utilizes Paraplex G-40 as the plasticizing material, made and sold by the defendant Plymouth Rubber Company, Inc., and sold by defendants in these consolidated cases, responds to all of the requirements of each of claims 1, 3, 4, 6, 7, 8 and 9 of reissue patent in suit, and infringes each of said claims.

54. The accused Plymouth Plastic Electrical Tape which utilizes Paraplex G-25 as the plasticizing material, made and sold by the defendant Plymouth Rubber Company, Inc., and sold by the defendant Sears, Roebuck and Company, responds to all of the requirements of each of claims 1, 3, 4, 6, 7, 8, and 9 of the reissue patent in suit, and infringes each of said claims.

LIBRARY
SUPREME COURT, U.S.

Office Supreme Court, U.S.
FILED
JAN 20 1958
JOHN T. FEY, Clerk

IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1957.

No. 673.

MINNESOTA MINING AND MANUFACTURING COMPANY,
Petitioner,

vs.

SEARS ROEBUCK AND COMPANY and THE PLYMOUTH RUBBER COMPANY, INC.,
Respondents.

REPLY BRIEF

Of Petitioner in Support of Petition for Writ of Certiorari.

LAWRENCE C. KINGSLAND,
ESTILL E. EZELL,
7912 Bonhomme Avenue,
St. Louis 5, Missouri,
HAROLD J. KINNEY,
900 Bush Avenue,
St. Paul 6, Minnesota,
M. K. HOBBS,
First National Bank Building,
Platteville, Wisconsin,
WELCH JORDAN,
Jefferson Standard Building,
Greensboro, North Carolina,
Attorneys for Petitioner.

St. Louis Law Printing Co., 415 North Eighth Street. CEntral 1-4477.

INDEX.

Page

A. A conflict of decisions arises 2

1. The specification is highly technical, contrary to respondents' argument 2

2. The "necessary" and "indispensable" testimony of the experts is that the patent discloses the use of a resinous plasticizer as the sole plasticizer—contrary to respondents' argument 5

3. In granting the reissue the Patent Office determined that the patent did not require two plasticizers—contrary to respondents' argument 7

Summary of point A 8

B. A new and doubtful question of law arises 9

Appendix 11

Cases Cited.

Graver v. Linde, 339 U. S. 605 8

Krementz v. Cottle, 148 U. S. 556 2

Seymour v. Osborne, 11 Wall. 516, 546 3

U. S. Industrial Chemicals, Inc., v. Carbide & Carbon Chemicals Corp., 315 U. S. 668 3

IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1957.

No. 673.

MINNESOTA MINING AND MANUFACTURING COMPANY,
Petitioner,

vs.

SEARS ROEBUCK AND COMPANY and THE PLYMOUTH RUBBER COMPANY, INC.,
Respondents.

REPLY BRIEF

Of Petitioner in Support of Petition for Writ of Certiorari.

On page 1 of their brief respondents deny that this is an appropriate case for certiorari. But contrary to respondents' assertion, there arise from this record:

1. A serious question of conflict between the decision of the Court of Appeals and applicable decisions of this Court; and

2. A new and doubtful question of law.

Matters of grave public interest and importance are raised by these questions.

On pages 1 and 2, respondents argue and assert (a) that the Court of Appeals made a finding "on a simple question of interpretation of a legal document"; (b) that the reversal of the District Court does not "constitute(s) a decision on a 'question of patent law'" (as if this Court's power in certiorari matters is limited to questions of patent law); and (c) that it "is indubitably clear to any reader

at all literate"[1] that the patent specification requires "two types of plasticizers", one liquid, one resinous.

Since each of these assertions, and others like them throughout respondents' brief, is directed to what the patent discloses and teaches, they can be answered jointly.

Respondents' oblique attack on the invention and the patent, which is beyond the issues properly raised, is discussed in an appendix, *infra*.

A. A CONFLICT OF DECISIONS ARISES.

1. The Specification Is Highly Technical, Contrary to Respondents' Argument.

The respondents plainly infer that the Court of Appeals, as a technical board of review, can determine what the patent discloses and teaches to the man skilled in the art without the aid of the testimony of such persons. Such principle may apply, for example, in the case of a simple invention such as a single piece collar button (**Krementz v. Cottle**, 148 U. S. 556); but it has no application to the instant case where questions of the functioning of plasticizers and the equivalence of substitutes present a complex and highly technical fact situation.

This is not a case of "simple question of interpretation of a legal document" (Br. p. 1). A patent is a contract only in the sense that it is a grant in consideration of a new and useful disclosure. Patents are not to be interpreted as agreements between private parties, but rather in the light of "what they actually say" to the man skilled in the art to whom they are addressed (35 U. S. C. 112). The Court of Appeals, in direct scorn of Rule 52 (a), ignored the findings of the District Court based upon the

---

[1] This statement is a direct insult to the District Court, who is both literate and experienced; and is a charge of incompetency and insincerity against the Patent Office, petitioner's counsel, and its witnesses.

testimony of those who know whereof they speak, men skilled in the art.

In so doing the Court of Appeals rendered a decision in direct conflict with decisions of this Court. In **Seymour v. Osborne,** 11 Wall. 516, 546, the Supreme Court said that "the testimony of scientific witnesses is indispensable."

Respondents cite at page 7 one of the very cases with which the Court of Appeals is in conflict on the question of necessity of expert testimony, namely, **U. S. Industrial Chemicals, Inc., v. Carbide & Carbon Chemicals Corp.,** 315 U. S. 668 (Petition, p. 13). In this case it is said to be "permissible, and often necessary," for the court "to receive expert evidence to ascertain the meaning of a technical or scientific term or term of art so that the court may be aided in understanding not what the instruments mean but **what they actually say**" (315 U. S. 678, emphasis added), i. e., what they teach or say to the man skilled in the art.

Having determined with the aid of expert evidence what an instrument **says**, the determination of the meaning as a matter of law is not then difficult.

Far from the "simple question of interpretation of a legal document" (Br. p. 1), the question of what the Oace patent teaches is technical and not understandable to the lay mind. Respondents themselves exhibit in their brief the difficulty the lay mind encounters, for four pages (5-9) of the brief and five pages of the Appendix (10-14) are devoted to a discussion of the patent and the evidence from their partisan point of view. The discussion proves petitioner's contention that the patent is technical. Respondents' discussion also proves the wisdom of the Supreme Court decisions that "the testimony of scientific witnesses is indispensable to a correct understanding."

The highly technical nature of the Oace patent and of this case is demonstrated by the many complex and technical background questions necessarily considered and re-

solved by the District Court as an aid to the interpretation of the Oace disclosure and in support of its ultimate finding of infringement, including the following importantly significant facts:

1. That in the process of polymerization, the nature and composition of the resultant product depends on controllable factors, as time, temperature, pressure, etc. (Finding 39, App. 50).

2. That Rohm & Haas "tailor-make" the polymerized resinous plasticizers for end uses, so that "they combine to a remarkable degree" the features both of liquid ester plasticizers and resinous plasticizers (Finding 40, App. 51), providing a tailored **hybrid**. The quoted language is from a Rohm & Haas publication (Deft. Ex. 42, R. II, 188).

3. That in 1954 Rohm & Haas announced to the public that it "**focused** their efforts on **tailoring** plasticizers to meet **specific**, often stringent, application and process requirements", referring at the same time to the "**very critical**" requirements of the vinyl electrical tape here involved (Deft's. Ex. 50, R. II, 189-190, emphasis added). It was in this year of 1954 that G-25 was first used by respondents as the sole plasticizer in commercial tape making. Respondent's expert Danovitch could not make tape with G-25 as the sole plasticizer in 1948-50 (R. II, 114).

4. That the whole of G-25 and of G 40 is liquid (Finding 41, App. 51).

5. That the more-liquid, lower-molecular-weight portion of each of the G-25 and G-40 used by respondents is a liquid ester plasticizer, as required by the claims (Findings 43, 51, App. 51, 53).

6. That sebacic (from G-25) and adipyl (from G-40) and phthalyl esters are each liquid and the equivalent of each other as plasticizers (Finding 44, App. 51).

7. That in the process of making G-25 and G-40 the unit building material of a molecular weight of 300-350 is not

removed (Finding 48, App. 52). Hence the statement of respondents, on page 4, that all the molecules of polymerized plasticizers "are varying **high** molecular weights" is plainly wrong, on the testimony of a Rohm & Haas witness (Dr. Beavers, R. II, 123-4). The number average molecular weight of G-25 is 8000; of G-40, 6000 (App. 35).

8. That G-25 has changed significantly since the patentees worked with it in 1944 and 1945 (Finding 49A-49H, App. 52-53).

9. That plasticizing is a physical not chemical, phenomenon (R. II, 26, 95).

10. That the plasticizers can be blended at any time one chooses (DeBell, R. II, 90).

2. The "Necessary" and "Indispensable" Testimony of the Experts Is That the Patent Discloses the Use of a Resinous Plasticizer as the Sole Plasticizer—Contrary to Respondents' Argument.

The respondents assert (Br. p. 7) that only one witness said the patent taught the use of a resinous plasticizer used solely. This is error:

(a) Tierney so testified specifically (R. II, 45, 15-16), as respondents admit (Br. p. 7).

(b) Oace so testified. On interrogation by respondents' counsel, as to whether he found in his "patent any suggestion that the use of some liquid plasticizer in the mix is or may be optional," Oace testified in the affirmative, saying (R. II, 140), referring to column 5, lines 21-26:

> "Well, now, I think to a laboratory man that would mean that the liquid plasticizer may be eliminated."

(c) Lundquist so averred in an affidavit in the Patent Office on the reissue application (R. II, 146-147).

(d) DeBell so testified; although respondent denies this (Br. p. 7). Interrogated about that portion of the

specification to which Oace referred (column 5, line 21 et seq.) which states that ethyl acrylate polymer "has somewhat less tendency to cause tack loss" than G-25 and "hence may be used in even greater amounts" than resin such as G-25 of that vintage, DeBell first protested, as respondent asserts (Br. 7), that the patent "has already taught me that alone the ethyl acrylate polymer does cause loss of tack" (R. II, 91).

But as the interrogation continued DeBell made these significant admissions (R. II, 92):

> "Q. And would you try 100 to 1 ratio of ethyl acrylate polymer to DOP? Would that be a fairly normal thing to do in running some of those simple tests? A. Yes.
>
> Q. Now if you still observed no tack loss there, wouldn't that suggest to you to go that other short step and forget the DOP entirely? A. Oh, I think so."

With these admissions on the part of DeBell, coupled with the showing that the Oace tape can be made with ethyl acrylate polymer as the sole plasticizer (Tierney Exh. 14; R. II, 15, 16) and coupled with the testimony of other witnesses, the trial court was clearly correct in its Finding 31 (App. 49) that

> "The patent discloses a plasticizing system which is satisfied by one or more ingredients of plasticizing material"

and that

> "The patent in suit teaches persons skilled in the art that ethyl acrylate polymer may be used as the plasticizer for the film backing of the tape of the patent."

Even if it be conceded arguendo that DeBell does not think, contrary to the clear import of his testimony, that the patent teaches the use of an all-resinous plasticizer (ethyl acrylate polymer) other witnesses so testified; the

District Court believed them; and so found (Finding 31, App. 49). Also the Patent Office earlier so found (see infra), which the District Court also considered. But, contrary to Rule 52 (a), the Court of Appeals tossed the District Court's finding aside.

3. In Granting the Reissue the Patent Office Determined That the Patent Did Not Require Two Plasticizers—Contrary to Respondents' Argument.

The Patent Office granted the reissue claims not requiring two plasticizers on an **unchanged** disclosure (Finding 32, App. 49-50). This action involved the necessary determination that the specification made such disclosure, contrary to respondents' assertions on pages 2 and 8 of their brief.

In the prosecution of the reissue application, Oace et al. said to the Patent Office (R. II, 145-146):

> "Suppose one attempted to evade the Oace et al. patent No. 2,559,990 by replacing the two plasticizers for the backing, specified in the original patent claims, by a single plasticizer which could combine the function and effect of the two named plasticizers. Would this avoid infringement?
>
> * * * * * * *
>
> ". . . 'It is obvious' that the functions of the two plasticizers could be combined into one (by appropriate application of the knowledge of chemistry) in duplicating applicants' novel electrical insulating tape.
>
> "Thus it is submitted that the new claims as a whole are not much, if any, broader in scope than the claims of the original patent, **when the doctrine of equivalents is properly applied** in determining what will infringe the latter claims. Of course, it always helps in a patent suit to have the matter of range of equivalency argued out in the Patent Office, where possible, so that the claims are **in terms** covering the devices or structures

charged as an infringement. That is one purpose of this reissue application."

Thus, the Patent Office was fully on notice of the actual and intended meaning of the reissue claims, having been told exactly what the patentees wanted, and why.

The respondents state that the reissue has "broadened" claims (Br. p. 12). They are broader **in terms** in respect to the plasticizer; but not materially broader in view of the nature of the invention claimed, viz., a stretchable and retractable pressure-sensitive vinyl plastic insulating tape. The Board of Appeals of the Patent Office held that reissue claim 6 (claim 16 of the reissue application) is "of substantially the same scope as were claims 1 to 5 inclusive allowed in the original patent" (R. II, 153). The grant of the reissue was a determination of claim support in the Oace specification for both the original and the reissue claims.

Summary of Point A.

In summary, to this point, it is reiterated that the Court of Appeals, contrary to the mandate of Rule 52 (a), overruled the concurring findings, as to what the Oace patent teaches, of the Board of Appeals of the Patent office, and of the District Court. In so doing that Court, as judges unskilled in the art, substituted their own inexpert reading of the patent for that of the experts.

This unwarranted action was in clear conflict with (a) the decisions of this Court which hold "necessary" and "indispensable" expert assistance to the inexpert[2] and (b) the decisions of this Court applying Rule 52 (a).[3]

This conflict with two established principles of law is of serious public importance. It is of grave concern to the smooth, equal and integrated administration of justice in the Federal Courts.

---

[2] See cases cited at pages 12-14 of Petition.

[3] See particularly *Graver v. Linde*, 339 U. S. 605, and other cases cited at pages 17-18 of Petition.

Contrary to respondents' argument (Br. 2), Question 1 of the petition is clearly raised on this record.

B. A NEW AND DOUBTFUL QUESTION OF LAW ARISES.

Beginning at page 8 of their brief, and continuing on page 9, respondents disclaim that the issue of whether an equivalent must have been known at the time of the application, or of the grant, is here involved. Petitioner is accused of trying to "inject" this issue.

Respondents injected the issue in their brief in the Court of Appeals (p. 29), referring "to the basic principle of equivalency as the substitution of 'another old ingredient for one of the ingredients of the patented combination * * * well known at the date of the patent' * * *."

The Court of Appeals referred to the issue of known equivalents in its first opinion (App. 36):

> "It may be that the lower weight molecules in the resinous plasticizers perform the function which the patent attributes to the liquid plasticizers in making the finished product with the result that both parties in the pending case now[4] find that G-25 or G-40 may be used as the only plasticizer; **but it is certain that the inventors were unaware of this fact** and maintained the contrary positions." (Emphasis added.)

At the argument to reopen, the Court of Appeals itself raised the question as to known equivalents.

In its second opinion, the Court of Appeals cited cases **pro** and **con** (App. 41).

Obviously, if, as petitioner contends and as the District Court found, the patent teaches the use of an all-resinous plasticizer, infringement of the original claims exists on

[4] But the G-25 of the time of the suit was not the G-25 that Pace et al. worked with in 1944-45; nor was it the G-25 that respondents' expert Danovitch could not use alone in 1948-50.

the basis of equivalents, **unless it is required that an equivalent must have been known at the date of grant.**

This case cannot be finally resolved without a determination of the legal question as to **when** an equivalent must have been known.

The patent bar has long waited for an answer to the question of "known equivalents" from a positive source. The statutory recognition of equivalents in the 1952 Act makes a definitive determination essential. Courts of appeal are in conflict on the question; and even differ as to what this Court has held (See Pet., pp. 20-21). This question alone furnishes an adequate basis for the allowance of the writ. This Court has not, but should, decide the question.

Actually, the generic, basic question in this case involves equivalents, for that question is:

> Shall a patent which provided a new article of commerce so unique and useful that it was hailed by General Electric as "revolutionary" (App. 48) be rendered valueless because by tailored polymerization there is produced a single plasticizer which will work alone to replace, and to provide the function and effect of, the two plasticizers preferred by the patentees?

in pronouncing such a result, the Court of Appeals has nullified the aim of the Patent Laws—to promote the progress of the useful arts.

The writ should be allowed.

Respectfully submitted,

LAWRENCE C. KINGSLAND,
ESTILL E. EZELL,
HAROLD J. KINNEY,
M. K. HOBBS,
WELCH JORDAN,
Attorneys for Petitioner.

January 17, 1958.

APPENDIX.

Respondents indulge in a sly attack on the invention and validity of the patent (Br. 3, 14), implying that all Oace did was to use old vintage G-25 for its intended purpose, casually citing this Court's decision in **Sinclair & Carroll v. Interchemical Corp.**, 325 U. S. 327. To the contrary, the record shows that the inventors spent many months in experimental work, during the course of which over 200 experiments were conducted with a large number of different formulations (R. II, 6-7; Finding 27, R. I, A6).

This innuendo is strangely out of tune with respondents' acknowledgment to the District Court at the beginning of the trial (R. II, 2):

> "I won't discuss the validity of this original patent. They (Oace et al.) did a very good technical job in putting these plasticizers together, and getting an excellent product. . . . I don't know why they weren't able to use G-25 satisfactorily, whether their technique was wrong. We always had a lot of trouble with it, or what happened. They weren't able to."

The tardy argument presented here by respondents also ignores Findings 24-30 (R. I, A5-A7) and General Electric's appraisal, as testified to by the witness Parker (R. II, 62):

> "For the first time in fifty years a revolutionary electrical tape is on the market . . ."

The District Court found that the "patent in suit exhibits invention of a high order" (Finding 24); also see generally Findings 19 to 29 (R. I, A4-A7).

Even the Court of Appeals recognized that—

> "* * * the patent was a great improvement over prior insulating devices and met with much commercial success" (App. 25).

When respondent Plymouth set out, in 1948, to make the accused tape, it admittedly had before it some of petitioner's "Scotch" Brand No. 33 tape and a publication of Bakelite Corp. showing "the physical and electrical properties of the pressure-sensitive, stretchable and retractable vinyl plastic tape sold commercially as 'Scotch' Brand Electrical Tape" (see Admissions, R. II, 160). Even so, respondent succeeded in making no substantial amount of tape until after the original Oace patent issued (July 10, 1951). "In 1950 and 1951, Plymouth's output was so small it did not bother to get the figures" (App. 48).

* * * * * * *

Respondent states or implies (Br. 4) that prior to G-25 (1943) there was no commercially available resinous plasticizer suitable for use in making the Oace tape. This is inaccurate.

Another resinous plasticizer which is like the 1945 vintage Paraplex G-25 in requiring some DOP or equivalent to be usable in making the Oace tape is Paraplex G-20, available commercially from Rohm & Haas since 1929 (R. II, 38). A roll of tape made with G-20 and DOP is in evidence as Tierney Exhibit 28. The similarity of G-20 to the early G-25 was acknowledged by Louis Klein of Rohm & Haas: pages 69-72 of Philadelphia depositions. Both are "polyester resins which are based on long-chain polybasic acid esterified with polyhydric alcohols such as glycol, for example" (Phila. Dep. p. 72).

Also ethyl acrylate polymer, disclosed in the patent, was *per se* old. A roll of tape made with ethyl acrylate polymer as the sole plasticizer is in evidence as Tierney Exhibit 14 (R. II, 15-16, 74).

LIBRARY
SUPREME COURT, U.S.

Office - Supreme Court, U.S.
FILED
JAN 9 1958
JOHN T. FEY, Clerk

Supreme Court of the United States.

OCTOBER TERM, 1957.

No. 673.

MINNESOTA MINING AND MANUFACTURING COMPANY, *Petitioner,*

v.

SEARS, ROEBUCK AND COMPANY AND THE PLYMOUTH RUBBER COMPANY, INC., *Respondents.*

BRIEF FOR RESPONDENTS IN OPPOSITION TO PETITION FOR WRIT OF CERTIORARI.

THORNTON H. BROOKS,
Attorney for Respondents.

HECTOR M. HOLMES,
H. L. KIRKPATRICK,
E. T. LEGATES,
Of Counsel.

Table of Contents.

The subject matter	3
The Oace patent in suit	5
No question of known equivalents involved or decided by the Court of Appeals in this case	8
Appendix	10

Table of Authorities Cited.

CASES.

U.S. Industrial Chemicals, Inc., v. Carbide & Carbon Chemicals Corp., 315 U.S. 668	7

In the
Supreme Court of the United States.

OCTOBER TERM 1957.

No. 673.

MINNESOTA MINING AND MANUFACTURING COMPANY, *Petitioner*,

v.

SEARS, ROEBUCK AND COMPANY AND THE PLYMOUTH RUBBER COMPANY, INC., *Respondents*.

BRIEF FOR RESPONDENTS IN OPPOSITION TO PETITION FOR WRIT OF CERTIORARI.

This is a patent suit brought in the Middle District of North Carolina by petitioner, Minnesota Mining of St. Paul, Minnesota, against Sears, Roebuck of Chicago and Plymouth Rubber of Canton, Massachusetts, the manufacturer, intervened as a defendant.

This is an ordinary patent suit, involving no conflict of decisions between different Courts of Appeals, no new or doubtful question of law, no conflict between the decision of the Court of Appeals and the applicable decisions of this Court or any other court, and no matter of public interest or importance.

First, petitioner asks for review of the finding of the Court of Appeals on a simple question of interpretation of a legal document, which in this case is a patent. The Court of Appeals found (1) that the specification of the Oace patent in suit comprises an "emphatic assertion" that "both

In the
Supreme Court of the United States.

OCTOBER TERM 1957.

No. 673.

MINNESOTA MINING AND MANUFACTURING COMPANY, *Petitioner*,

v.

SEARS, ROEBUCK AND COMPANY AND THE PLYMOUTH RUBBER COMPANY, INC., *Respondents*.

BRIEF FOR RESPONDENTS IN OPPOSITION TO PETITION FOR WRIT OF CERTIORARI

This is a patent suit brought in the Middle District of North Carolina by petitioner, Minnesota Mining of St. Paul, Minnesota, against Sears, Roebuck of Chicago and Plymouth Rubber of Canton, Massachusetts, the manufacturer, intervened as a defendant.

This is an ordinary patent suit, involving no conflict of decisions between different Courts of Appeals, no new or doubtful question of law, no conflict between the decision of the Court of Appeals and the applicable decisions of this Court or any other court, and no matter of public interest or importance.

First, petitioner asks for review of the finding of the Court of Appeals on a simple question of interpretation of a legal document, which in this case is a patent. The Court of Appeals found (1) that the specification of the Oace patent in suit comprises an "emphatic assertion" that "both

types of plasticizers must be used," and (2) that the finding of District Judge Hayes* to the contrary is "beyond question . . . clearly erroneous" (App. 31).† Petitioner asserts that in so finding the Court decided an "important question of patent law . . . in a manner in conflict with the decisions of this Court" (Br., p. 11). Petitioner does not show wherein the Court's reversal of the District Court for clear error constitutes a decision on "a question of patent law," much less a decision of patent law "in conflict with decisions of this Court."

Nor is petitioner supported by the record as to the alleged facts relied upon to support its petition. In support of its position petitioner asserts that the specification of the patent is of such a "deeply technical" character that only a man skilled in the art can say what the patent teaches and discloses, and erroneously asserts that the experts of both parties agreed that the specification taught the use of a resin plasticizer as the sole plasticizer, contrary to the finding of the Court of Appeals. On the contrary, the teaching of the Oace specification that the two types of plasticizer are required is indubitably clear to any reader at all literate, and petitioner's continued assertion that the experts of both parties agreed that the specification taught what petitioner asserts is a gross misrepresentation (*infra*). Moreover, the Patent Office made no such finding as the teaching of the Oace patent, as petitioner also erroneously asserts.

Second, petitioner contends, as we read the petition, that the Court of Appeals in finding absence of infringement because one element specified as essential and called for by the original claims in issue‡ (8 to 20 parts of a liquid plasti-

*The findings of the District Court were the findings submitted by the petitioner, without change.

†As in Petitioner's Brief, "App." refers to appendix to the petition.

‡The broadened reissue claims we refer to in our appendix (*infra*).

cizer) was entirely omitted in the accused product, the plasticizer of which was completely resinous, relied upon and enunciated a doctrine of known equivalents, as to which, petitioner asserts, there is some controversy in the cases which should be resolved by this Court. On the contrary, no question of whether an equivalent must have been known at the date of the patent arose in this case, and indeed the Court of Appeals decided that no question of equivalents was involved, and specifically avoided expressing any opinion as to the doctrine of known equivalents (App. 41), which petitioner had tried to inject into the case.

The Court of Appeals has not applied or enunciated any law as to known equivalents. Therefore there is in this case no holding as to the law of known equivalents to be reviewed.

We believe it will help this Court to understand the simple issues involved in this case if we briefly review the salient facts and the careful decision of the Court of Appeals, a court experienced in patent cases.

The Subject Matter.

The Oace patent in suit is concerned with a tape having a pressure-sensitive adhesive (an old type of adhesive) on a backing made of vinyl (plastic) instead of rubber or cellophane or fabric or what not, as in former pressure-sensitive adhesive tapes.

The properties and characteristics of vinyl were well known, including its high insulating quality for electrical purposes (R. I, 79). The advent of plastic tape is the familiar one of a new synthetic material (vinyl) being adopted as time went on for a succession of new uses, where its known properties find useful application.

Vinyl, when mixed with a compatible plasticizer, becomes elastic and pliable substantially in proportion to the amount of plasticizer employed. Prior to the war the available

plasticizers compatible for vinyl were what are known as "liquid" plasticizers, *e.g.*, dioctyl phthalate (DOP). "Liquid" plasticizers are monomeric. That is, they are simple, precise compounds of low molecular weight, in which every molecule is like every other molecule in size and weight (App. p. 35). "Liquid" plasticizers are as thinly fluid as water.

Petitioner, the giant in the tape industry, had recognized that plasticized vinyl (plastic) would be useful for a tape backing because of its known properties, but was unable to make a successful plastic tape because the available compatible plasticizers, being of the liquid type, are migratory, and, if used in sufficient quantity to give to the vinyl tape backing the desired elasticity, migrate into the adhesive and make it pasty (R. I, 50-51, 54, 49).

In 1943 Rohm & Haas, a large and distinguished chemical firm, brought out a new plasticizer (G-25), which is a resin type plasticizer, highly compatible with all vinyls to plasticize them, and non-migratory, as Rohm & Haas publicized when active sales development began in October, 1943.* A resin type plasticizer is a well-known and distinctive type of plasticizer. The resin plasticizers here involved are polymeric, of high molecular weight, viscous like thick molasses, and all the molecules, by polymerization, comprise heavy, sluggish, chemically-linked molecules or chains, so called, of varying high molecular weights (App. 35; R. I, 82, 72-73).

On the advent of G-25, petitioner renewed its interest in plastic tape and tried G-25 as a non-migrating plasticizer (R. I, 48), as did others who had a problem of plasticizer migration (R. I, 34-37).

Petitioner found that when the non-migrating G-25 was used as the sole plasticizer it did not migrate to make the

*Prior to G-25 there was no commercially available non-migrating plasticizer compatible with the high chloride content vinyls required for tape.

adhesive pasty, but for some reason dried out the adhesive and made it non-tacky (R. I, 139). To overcome this defect, petitioner mixed a limited quantity of a liquid plasticizer (DOP) with a resin type plasticizer, and found that this mixture satisfied its requirements (R. I, 48), and made a superior product. Thereupon plaintiff went into production with its commercial plastic tape, in which the vinyl backing was plasticized with a mixture of something under 20 parts of liquid plasticizer (DOP) and the balance of the non-migrating resin plasticizer (G-25) (R. I, 55, 65). And thereafter, on January 12, 1946, the application for the Oace patent in suit was filed. (The patent issued July 10, 1951.)

The Oace Patent in Suit.

The specification describes the prior art substantially as described above—the substitution for rubber of vinyl (col. 1, lines 5 *et seq.*) for its known properties, its use in the form of strips (tapes), and previous efforts to provide such strips or tapes with adhesive. But if less than 20 parts of the "liquid type" plasticizer was used, there was not sufficient elasticity, and if enough was used to give the required elasticity, the plasticizer migrated and the adhesive became tacky (col. 2, lines 27 *et seq.*).

The specification then states (col. 3, l. 21 *et seq.*) that applicants had succeeded in producing permanent equilibrium between backing and adhesive by using the mixture of a "high molecular weight resinous type of plasticizer . . . together with the liquid plasticizer." G-25 is referred to as a "preferred example of a suitable resinous type plasticizer," and other examples were mentioned—ethyl acrylate and vinyl butyl ether (col. 3, lines 40-45).

The specification then states (col. 3, lines 45 *et seq.*) that, while "resinous or high molecular weight modifiers, such

as 'Paraplex G-25' " give the desired stretch and strength, and are "generally classed as non migrating . . . it is surprisingly found that these materials do not provide for permanent equilibrium of adhesive and backing . . . Instead it has been shown that pressure-sensitive adhesives in prolonged contact with highly sensitive and elastic films consisting solely of vinyl polymer and resinous modifier lose a great deal if not all of their tackiness and pressure-sensitivity."

"Liquid" plasticizers other than DOP are referred to (col. 5, line 1 *et seq.*). "Likewise, various compatible non-migrating resinous plasticizers may be substituted" for the G-25 "heretofore mentioned" (col. 5, lines 16-20). The specification states that ethyl acrylate (one of the examples of resin plasticizer previously mentioned) "has somewhat less tendency to cause tack loss than does the 'Paraplex G-25' and hence may be used in greater amounts in many formulations."

The claims of the original patent (see Claim 1 in issue, App. 23) specifically call for the mixture of the two types of plasticizer—a specified amount of "liquid" plasticizer and the balance a resin plasticizer.

The specification, therefore, clearly taught, as the Court of Appeals found "beyond question" (App. 31), that "both types of plasticizer must be used to give good results." The use of either type of plasticizer as the sole plasticizer was disclaimed. Indeed, as the Court of Appeals said (App. 31), the specification is "emphatic" in this regard, as indeed it is.

To support its argument that this finding of the Court of Appeals constitutes an erroneous decision of patent law, petitioner argues that only a man skilled in the art can determine the patent teaching and disclosure and, second, that in the present case the men skilled in the art (the experts of the two parties) are in agreement that the Oace

patent teaches the use of a resin plasticizer as the sole plasticizer and does not teach that both types are to be used.

As this Court stated in *U.S. Industrial Chemicals, Inc.*, v. *Carbide & Carbon Chemicals Corp.*, 315 U.S. 668, 678, a case relied upon by petitioner (Br., p. 13), it is proper to receive expert evidence as to the meaning of technical terms or words of art to aid in understanding "not what the instruments mean, but what they actually say." The meaning of the instrument is for the Court to determine. The experts in this case did testify as to the meaning of "polymer," "liquid plasticizer," "resin type plasticizer," etc., and were in agreement on these matters. And, moreover, the experts were not in agreement, as petitioner repeatedly asserts, that the patent taught and disclosed the use of a resin type of plasticizer as the sole plasticizer. Only petitioner's witness Tierney, an officer of petitioner (App. 31), ventured any such opinion. In the testimony of opposer's expert, DeBell, cited by petitioner to show the "agreement" of the two experts (R. II, 91-92; see Petitioner's Br., p. 10), DeBell testified exactly to the contrary. He stated that, if he tried ethyl acrylate (one of the resin plasticizers referred to in the patent, col. 3, line 43; and see col. 5, line 21), and it worked, I would figure that I had found something new over the patent, because that has already taught me that alone the ethyl acrylate polymer does cause loss of tack."

The patentees of the Oace patent (all petitioner's employees) were presumably people skilled in the art, and they have not agreed that their specification teaches the use of a resin plasticizer as the sole plasticizer. On the contrary, they pointed out to the Patent Office, to distinguish the prior art, that their specification made it "clear" that the "three-way blend" (the vinyl and the liquid and the resin plasticizers) "is essential to the success" of their product, that the specification points out that a liquid plas-

ticizer cannot be used alone and that a resin plasticizer cannot be used as the sole plasticizer (see footnote 4 to Court of Appeals Opinion, App. 31-32).

Nor is there any finding by the Patent Office, as petitioner's brief asserts, that the patent in suit taught and disclosed the use of a resin plasticizer as the sole plasticizer.

Secondly, petitioner (Br., p. 13) cites the paragraph of the patent at col. 5, lines 31-38, as a teaching and disclosure of the use of a resin plasticizer as the sole plasticizer. This paragraph is but the customary patent statement as to ratios or proportions of specified ingredients, and merely says that, where particular ratios of the three ingredients, the vinyl and the two types of plasticizer, are described, those ratios may be altered, etc. There is no teaching or suggestion in this paragraph (or anywhere else in the patent) that any one of the three ingredients may be entirely omitted.

The holding of the Court of Appeals that the District Court's finding as to the teaching and disclosure of the patent was "beyond question . . . clearly erroneous" was not a decision of "an important question of patent law . . . in conflict with the decisions of this Court" (Br., p. 11). Petitioner cites no decision of this Court which holds that a Court of Appeals cannot, as a matter of patent law, reverse a lower court's finding as to the meaning and disclosure of a patent, however clearly erroneous such finding may be. This asserted ground for further review does not bear scrutiny.

No Question of Known Equivalents Involved or Decided by the Court of Appeals in This Case.

Petitioner states as its second basis for further review that the question of whether an equivalent must have been

known at the time of the invention arose in this case, that the existing law as to this question is *not clear, and* that this Court should grant the petition because this case presents an issue of law which should be clarified by this Court.

The question of known equivalents did not arise in this case. The Court of Appeals not only made no decision on this question, but held that the doctrine of equivalents was not involved in this case, and further explicitly refrained from considering or passing on the doctrine of known equivalents, which petitioner had tried to inject into the case (App. 41). Therefore, since the Court of Appeals did not apply or enunciate any law as to the question of known equivalents, there is no holding as to the law of known equivalents to be reviewed.

We submit that we have adequately demonstrated that petitioner has shown no warrant for review in this case.

In the event that this Court has any further interest in the facts and several issues as applied by the Court of Appeals, we attach an appendix in which we summarize the issues and the holding of the Court of Appeals.

Respectfully submitted,

THORNTON H. BROOKS,
Attorney for Respondents.

HECTOR M. HOLMES,
H. L. KIRKPATRICK,
E. T. LEGATES,
Of Counsel.

Appendix.

The original Oace patent issued July 10, 1951, with the first five claims as they appear in the reissue patent. Claim 1 is representative and, bereft of its patent jargon, may be accurately summarized as calling for a pressure-sensitive adhesive insulating tape having (1) *a backing of vinyl* including a major proportion of vinyl chloride (a then commercial vinyl useful for tape), mixed with (2) *a liquid plasticizer* (in an amount of 8 to 20 parts) and (3) *a resin plasticizer*, and (4) *a "rubber resin" type of pressure-sensitive adhesive* (the standard pressure-sensitive adhesives were of the "rubber resin" type).

The facts here summarized are as stated by the Court of Appeals.

The accused tapes were made by Plymouth Rubber Co., which intervened as party defendant in this suit brought against its customer, Sears, Roebuck of Chicago.

In 1950, long prior to the issue of the original Oace patent in July, 1951, Plymouth began manufacture and sale of a plastic tape in which it used as the sole plasticizer a resin type plasticizer of Rohm & Haas, known as G-40, no liquid type plasticizer being used. G-40, which came out in 1945, is a non-migrating resin type plasticizer. Petitioner by early 1946 evaluated it, found it "equivalent to G-25," and found that when used as the sole plasticizer with its adhesives some loss of tack resulted, as was true of G-25 (R. I, 140). G-40 was cheaper than G-25 and petitioner in 1946 substituted in its commercial tape substantially the same quantity of G-40 for its G-25 in its G-25-DOP *mixture* (R. I, 65-66), of its 1945 commercial product.

Subsequently, but prior to this suit, Plymouth also commenced making tape in which G-25 was the sole plasticizer. As we have seen, G-25 was completely resinous.

As we have seen, the Oace patent teaches, as the Court of Appeals found, that *both* a liquid and a resin plasticizer "*must be* used,"* and claim 1, as we have seen, consistently with the teaching of the specification, calls for the use of both of the two distinctive different types of plasticizer, liquid and resin.

Therefore, as the Court of Appeals stated (App. 33), "the crucial inquiry is whether G-25 and G-40 actually contain a liquid as well as a resinous element."

At one stage of the case petitioner contended that, after 1944, G-25 did contain "both liquid and resinous portions" (App. 33). But Tierney on cross-examination admitted that "all portions" of G-25 are resinous (R. I, 67, 74), as found by the Court of Appeals (App. 36). Petitioner now makes no contention that G-25 and G-40 are and always have been other than completely resinous.

The Court of Appeals (App. 29) therefore held that these G-25 and G-40 tapes do not infringe such a claim as claim 1 "because they omit from their production one element or ingredient, to wit, the liquid plasticizer, which is specified in the claims of the patent," a basic principle of patent law not challenged by petitioner.

Petitioner had further contended that G-25 and G-40 contained very heavy molecules and less heavy molecules (as do all resin plasticizers) and that the less heavy molecules perform the function of the liquid plasticizer in making the finished product. The idea seemed to be that there was in G-25 and G-40 some undisclosed molecular weight distribution of resin molecules that would "do the trick" and that G-25 had been changed in this regard since its original manufacture.

*A probable explanation of petitioner's failure with a resin plasticizer as the sole plasticizer would appear to reside in the particular adhesive formula it used.

The Court of Appeals (App. 36) pointed out that even if the lower weight molecules in the resinous plasticizers perform the function of the liquid plasticizers, so that G-25 and G-40 may be used as the sole plasticizer, "it is certain" that the patentees "maintained to the contrary" and use of these plasticizers constitute infringement "because the plasticizer would still be completely resinous whereas the patent teaches that a liquid as well as a resinous plasticizer must be used." The Court of Appeals further pointed out (App. 32) that the Oace patent left it to future investigators to find by their own experimentation a resinous plasticizer that could be used as the sole plasticizer, if they could (or the proper adhesive for use with resin plasticizer). And, if such discovery is made, it is not that of Oace *et al.* and the Oace patent cannot be stretched like a nose of wax to cover a subsequent discovery or advance in the art nowhere described or suggested in the Oace patent.

Where an element or ingredient taught to be essential and included in the claim (here the liquid plasticizer) is omitted, the doctrine of equivalents is not involved and cannot be used to extend coverage beyond and inconsistent with the patent teaching. The patentee "may not recapture," on the ground of equivalency, that which he has disclaimed or rejected (*Acme Steel Co.* v. *Eastern Venetian Blind Co.*, 130 F. Supp. 459, 465; aff. 27 F. 2d 914, 4 Cir.; *Kaumagraph Co.* v. *Superior Trade Mark Co.*, 72 F. 2d 417, 419, 2 Cir.; *James P. March Corp.* v. *U.S. Gauge Co*, 129 F. 2d 161, 7 Cir.; *Banning* v. *Sears, Roebuck*, 88 F. 2d 45, 47, 6 Cir.).

The Reissue. On July 9, 1952, just short of one year after the grant of the original Oace patent with its limited claims specifying liquid and resin plasticizers, petitioner filed application for reissue, to broaden the claims to cover the tapes made by Plymouth and others (utilizing a resin

plasticizer as the sole plasticizer) which petitioner knew of and tested at least as early as May, 1951 (R. I, 151), prior to the issue of the original patent. The reissue was granted with four claims, of which claim 6 (App. 24) is representative. Claim 6, reduced to simple terms, defines a tape with a vinyl backing, plasticized with a plasticizing material "comprising at least a major proportion of a non-migrating viscous plasticizer resin" and the usual adhesive. Just what the scope of this language is may be open to question. "Comprising" has two well-recognized dictionary meanings—it may mean (1) "including" or (2) "consisting of," which would close the claim to any plasticizer ingredient other than resin plasticizer. "It has been established in patent practice that the terms 'comprise' and 'contain' are not exclusive of other materials in contrast with 'consisting of' or 'composed of'" (*Ex parte Glycofrides*, 63 U.S.P.Q. 242, 243, and cases there cited). If in claim 6 "comprising" means "consisting of," then the claim is inconsistent with and antithetical to the Oace specification, which, as we have seen, disclaims the use of a plasticizing material which is solely resinous.

The Court of Appeals did not have to resolve the question of the scope of what it termed "this dubious phrase." For, as the Court said, if the phrase "means that only a resinous plasticizer need be used, the claim is invalid because it goes beyond the disclosure of the original patent; if, on the other hand, the phrase means that both liquid and resinous plasticizers are to be used, the claim is not infringed by the defendants" (App. 36). The Court had earlier pointed out (App. 29)—and again in denying petitioner's motion to reopen (App. 40)—that on authority of the leading case of *U.S. Industrial Chemicals, Inc.*, v. *Carbide & Carbon Chemicals Corp.*, 315 U.S. 668, the reissue claims, if broad enough to cover the use of a resin plasticizer as the sole plasticizer (omitting the

liquid plasticizer prescribed in the original), are invalid. The *Carbide* case is on all fours with the present case, if, as is essential for infringement, the reissue claims are interpreted to cover a plasticizer material in which liquid plasticizer is entirely omitted.

The Court of Appeals had no occasion to consider further sound defenses against the reissue—invalidity because no "error"; invalidity for absence of diligence in filing the broadened application; and defendants' intervening rights. Nor did the Court of Appeals have occasion to consider the question of patentable invention—namely, if the Oace patent covers the use of a non-migrating plasticizer as the sole plasticizer, did it involve patentable invention (even if it can be said that Oace *et al.* were the first to make a tape using resin plasticizer as the sole plasticizer) to adopt a new plasticizer (such as G-25) because of its well-known quality of non-migration, to meet the known requirement of non-migration? (See *Sinclair & Carroll* v. *Interchemical Corp.*, 325 U.S. 327.)

LIBRARY
SUPREME COURT. U. S.

Office - Supreme Court, U.S.
FILED
FEB 21 1958
JOHN T. FEY, Clerk

IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1957.

No. 673.

MINNESOTA MINING AND MANUFACTURING COMPANY,
Petitioner,

vs.

SEARS ROEBUCK AND COMPANY and THE PLYMOUTH RUBBER COMPANY, INC.,
Respondents.

PETITION FOR REHEARING.

LAWRENCE C. KINGSLAND,
ESTILL E. EZELL,
7912 Bonhomme Avenue,
St. Louis 5, Missouri,
HAROLD J. KINNEY,
900 Bush Avenue,
St. Paul 6, Minnesota,
M. K. HOBBS,
First National Bank Building,
Platteville, Wisconsin,
WELCH JORDAN,
Jefferson Standard Building,
Greensboro, North Carolina,
Attorneys for Petitioner.

St. Louis Law Printing Co., Inc., 415 N. Eighth Street. CEntral 1-4477.

INDEX.

	Page
Foreword	1
I. This court can and should authoritatively determine the issues surrounding the Oace patent to resoive multiple pending litigation	2
II. An important question of federal law has been decided in conflict with decisions of this court	3
Conclusion	10
Certificate	10

Cases Cited.

Eicks v. Houghton, 248 F. 2d 394 (C. A. 7—1957)	8
Georgia Kaolin Company v. Thiele Kaolin Company, 228 F. (2d) 267 (C. A. 5—1955)	7
Graver Tank & Mfg. Co. v. Linde Air Products Co., 336 U. S. 271, 275, 93 L. ed. 672, 676 (1949)	4, 6
Marks v. Polaroid Corporation, 237 F. (2d) 428 (C. A. 1—1956)	6
Minnesota Mining & Manufacturing Company v. Pine State Electric Supply Co., Inc., et al., United States District Court for the Middle District of North Carolina, Civil Action No. 879-G	3
Minnesota Mining & Mfg. Co. v. Permacel-LePage's, Inc., C. A. 57 C. 1888, Northern District of Illinois, Eastern Division	2
Minnesota Mining & Mfg. Co. v. Plymouth Rubber Co., Inc., et al., C. A. 54 C. 1115, Northern District of Illinois, Eastern Division	2
Minnesota Mining & Mfg. Co. v. Superior Insulating Tape Co., C. A. 9967 (2), Eastern District of Missouri, Eastern Division	2

Minnesota Mining & Mfg. Co. v. Technical Tape Corp. et al., C. A. 54 C. 1116, Northern District of Illinois, Eastern Division 2

Minnesota Mining & Mfg. Co. v. The Goodyear Tire & Rubber Co., Inc. et al., C. A. 1026-G, Middle District of North Carolina 2

Minnesota Mining & Mfg. Co. v. United States Rubber Co. et al., C. A. 336-R, Middle District of North Carolina 2

Simmons Co. v. A. Brandwein & Co., 115 U. S. P. Q. 307 (C. A. 7—1957) 8

United States v. First Trust Co. of St. Paul, 116 U. S. P. Q. 172 (C. A. 8—1958) 9

United States v. National Association of Real Estate Boards, 339 U. S. 485 ..... 3-4, 5

U. S. v. Yellow Cab Co., 338 U. S. 388 ..... 4, 5

Weller Manufacturing Company v. Wen Products, Inc., 231 F. (2d) 795 (C. A. 7—1956) 7

Rules Cited.

Rule 19 of the Revised Rules of Supreme Court of United States 2

Rule 52 (a), Rules of Civil Procedure 1, 3, 4, 6, 10

IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1957.

No. 673.

MINNESOTA MINING AND MANUFACTURING COMPANY,
Petitioner,

vs.

SEARS ROEBUCK AND COMPANY and THE PLYMOUTH RUBBER COMPANY, INC.,
Respondents.

PETITION FOR REHEARING.

Foreword.

On January 27, 1958, this Court denied the Petition for Writ of Certiorari in this case. The reasons submitted for granting the petition have been reviewed in detail, and it appears that a basic question of Federal law concerning the application and conclusiveness of Rule 52 (a) of the Rules of Civil Procedure raised by the court below and obvious on the face of the opinion, while indicated, was not presented for consideration. There also exists an additional special and important reason comprising multiple litigation on the Oace patent. These reasons compel the presentation of this petition for rehearing, and follow in reverse order.

I. This Court Can and Should Authoritatively Determine the Issues Surrounding the Oace Patent to Resolve Multiple Pending Litigation.

Rule 19 of the Revised Rules of this Court states that "A review on writ of certiorari is not a matter of right, but of **sound judicial discretion**, and will be granted only where there are **special** and **important reasons** therefor. * * *" (Emphasis added.) Several reasons considered "special and important" follow this quoted portion, but the rule prefaces the same with the significant statement that the enumerated reasons **neither control** nor **fully measure** the Court's discretion.

It is earnestly submitted that a special and important reason exists in this case, which, while not in the enumerated group, warrants granting this petition and allowing certiorari. The Oace patent is presently involved in a number of suits in various Circuits. It is the basis of six unadjudicated actions, namely:

Minnesota Mining & Mfg. Co. v. Technical Tape Corp. et al., C. A. 54 C. 1116, Northern District of Illinois, Eastern Division;

Minnesota Mining & Mfg. Co. v. Plymouth Rubber Co., Inc. et al., C. A. 54 C. 1115, Northern District of Illinois, Eastern Division;

Minnesota Mining & Mfg. Co. v. Permacel-LePage's, Inc., C. A. 57 C. 1888, Northern District of Illinois, Eastern Division;

Minnesota Mining & Mfg. Co. v. Superior Insulating Tape Co., C. A. 9907 (2), Eastern District of Missouri, Eastern Division;

Minnesota Mining & Mfg. Co. v. United States Rubber Co. et al., C. A. 336 R, Middle District of North Carolina;

Minnesota Mining & Mfg. Co. v. The Goodyear Tire & Rubber Co., Inc. et al., C. A. 1026-G, Middle District of North Carolina.

It stands adjudicated infringed in a judgment in the case of **Minnesota Mining & Manufacturing Company v. Pine State Electric Supply Co., Inc., et al.**, United States District Court for the Middle District of North Carolina, Civil Action No. 879-G, which was not appealed.

This prospective extended litigation involving the same or similar issues as here comprises a special and important reason for the exercise of this Court's discretion to grant certiorari and to authoritatively determine the scope of the Oace patent and other issues here. Both public and private interests are involved, the latter being secondary to the former. Action by this Court now to resolve the contested questions will avoid the extensive litigation. Such action will be in the public interest, will conserve the time of the courts, and will insure uniformity of decision concerning the same subject matter.

It is respectfully urged that this Court take jurisdiction **now** and authoritatively determine the issues surrounding the Oace patent, thereby terminating the prospective extended litigation, which will be in the interests of the courts, the public, and the litigants.

II. An Important Question of Federal Law Has Been Decided in Conflict With Decisions of This Court.

Rule 52 (a) of the Rules of Civil Procedure provides in the pertinent portion:

> "* * * Findings of fact shall not be set aside **unless clearly erroneous**, and due regard shall be given to the opportunity of the trial court to judge of the **credibility** of the witnesses * * *." (Emphasis ours.)

The Rules of Federal Procedure are statutorily authorized and have the effect of statute.

What does the quoted portion of Rule 52 (a) mean? This Court has spoken authoritatively upon its binding effect on Appellate Courts. In **United States v. National**

Association of Real Estate Boards, 339 U. S. 485, Mr. Justice Douglas for this Court said (p. 495):

> "It is not enough that we might give the facts another construction * * *."

In **U. S. v. Yellow Cab Co.,** 338 U. S. 388, Mr. Justice Jackson pointed out that where the evidence would support a conclusion either way (p. 342):

> "* * * Such a choice between two permissible views of the weight of evidence is not 'clearly erroneous' * * *."

In **Graver Tank & Mfg. Co. v. Linde Air Products Co.,** 336 U. S. 271, 275, 93 L. ed. 672, 676 (1949), Mr. Justice Jackson said (p. 275):

> "The rule requires that an appellate court make allowance for the advantages possessed by the trial court in appraising the significance of conflicting testimony and reverse only 'clearly erroneous' findings. * * *"

It is clear from its opinion that the Court below as a matter of law has misapprehended the mandate of Rule 52 (a) as construed by this Court and as followed by most other Circuit Courts of Appeal. The trial court, on a record consisting of over twenty-five hundred pages and including over two hundred exhibits, made inter alia specific fact findings in support of its ultimate fact findings of infringement after analyzing a **mass** of **conflicting** evidence. Reference is made to Findings of Fact Nos. 31, 46 and 51, quoted in the footnote.* The Court of Appeals, as its

* "31. The patent in suit teaches persons skilled in the art that ethyl acrylate polymer may be used as the plasticizer for the film backing of the tape of the patent. The patent discloses a plasticizing system which is satisfied by one or more ingredients of plasticizing material. There is in evidence a roll of pressure-sensitive insulating tape wherein the film backing is 100 parts of VYNS vinyl chloride

opinion shows, **re-evaluated** and **reweighed** critical portions of the evidence, **judging credibility** of witnesses without benefit of observation and without opportunity to examine them, and chose, for example, to believe DeBell, respondent's witness, over the contrary testimony of Tierney and Oace, petitioner's witnesses, that had been believed by the trial judge, and to believe a single conclusion of one Bergen over an accumulation of contrary evidence credited by the trial judge. On the critical fact issue of infringement, the court below set aside the trial court's finding on the statement: "Our examination of the record convinces us that the findings on which this conclusion is largely based are not in accord with the great weight of the evidence."

The Court below **did** give the facts another construction, contrary to this Court's admonition in **United States v. National Association of Real Estate Boards, supra**, it **did** make a choice different from the trial court in respect to the weight of the evidence contrary to this Court's clear statements in **U. S. v. Yellow Cab Co., supra**, and did judge

credibility of witnesses, contrary to this Court's statement in **Graver v. Linde, supra.**

That the correction of the misapprehension of the Court below of Rule 52 (a) is of great public importance becomes strikingly clear when decisions of other Courts of Appeal are reviewed. Most follow the above quoted directives of this Court, while at least one other is to the contrary. Litigants, each of whom is a part of the public alluded to so often, are entitled to uniformity of legal construction of Rule 52 (a), one of the most important facets of the Rules of Civil Procedure. To know how this rule is interpreted is essential to proper preparation for trial.

It is not possible to review all pertinent late decisions of the Courts of Appeals, but the following illustrate the point:

1. Decisions from the First, Fifth and Seventh Circuits following this Court's directives in respect to Rule 52 (a):

In **Marks v. Polaroid Corporation,** 237 F. (2d) 428 (C. A. 1—1956), Judge Woodbury said (p. 435):

> "This brings us to the question of infringement which again does not call for extended discussion. The District Court found that the defendant Depix Corporation used substantially Land's materials and process to produce substantially Land's product. Its finding is based on the testimony of expert witnesses called by Polaroid who the court below found had made exhaustive scientific tests of Depix' material, and on moving pictures of Depix process shown in court. To be sure this evidence was contradicted by experts called by the plaintiff. Nevertheless the court below was certainly entitled to give controlling significance to the defendant's evidence. Further discussion would serve no purpose. It will be enough to say that the District Court's finding of infringement, rest-

ing as it does on substantial evidence which the court below found convincing, is not open to successful attack on appeal."

In **Georgia Kaolin Company v. Thiele Kaolin Company**, 228 F. (2d) 267 (C. A. 5—1955), Judge Rives said (p. 275):

"* * * In a patent case where the controlling facts are without significant dispute, infringement may conceivably become a question of law for an appellate court, but where, as here, the testimony is in sharp conflict on material particulars, infringement must of necessity be viewed as a question of fact to be resolved by the fact finder on a credibility basis like any other factual issue. See Fritz W. Glitsch & Sons, Inc., v. Wyatt Metal & Boiler Works, 5 Cir., 224 F. 2d 331. Though an occasional injustice may result, we think it by far the better practice in patent litigation, as elsewhere, for the essential facts to be resolved at the fact-finding level, than for appellate courts without clear warrant to usurp the fact-finding function."

In **Weller Manufacturing Company v. Wen Products, Inc.**, 231 F. (2d) 795 (C. A. 7—1956), Judge Lindley said (p. 797):

"* * * We say this, because, inasmuch as Judge Barnes had before him in a 9 days' trial, the extended controversial testimony of expert witnesses on behalf of the respective parties, as well as that of the patentee, certain witnesses skilled in technical learning and other witnesses concerning certain pertinent factual matters, in addition to extensive documentary evidence, models and other physical exhibits, the rule we announced in Hazeltine Research, Inc., v. Admiral Corp., 7 Cir., 183 F. 2d 953, certiorari denied 340 U. S. 896, 71 S. Ct. 239, 95 L. Ed. 650, is applicable to the present situation. In other words, just as, in that case, we felt that, in view of the conflicting testimony of expert witnesses and other controversial testimony,

we were not at liberty to deny the applicability of Rule 52 (a) of the Federal Rules of Civil Procedure, 28 U. S. C., so here, after an examination of the record and consideration of the conflicts between the witnesses, we have no right, we think, **to redetermine the findings of fact of the District Court** or to say, as a matter of law, that they are clearly erroneous. * * *" (Emphasis added.)

In **Simmons Co. v. A. Brandwein & Co.**, 115 U. S. P. Q. 307 (C. A. 7—1957), Judge Major said (p. 311):

"We have given careful consideration to the contentions pro and con regarding such findings, together with the evidence, oral and documentary, and come to the conclusion that they are justified by the record. Certainly we are not prepared to hold that they are 'clearly erroneous' under Rule 52 (a) of the Federal Rules of Civil Procedure.

"Plaintiff apparently ignores this rule applicable upon appellate review and argues that the findings are 'contrary to the weight of the evidence.' * * *"

In **Eicks v. Houghton**, 248 F. 2d 394 (C. A. 7—1957), Judge Hastings said (pp. 396, 397):

"This being a trial without a jury and the court having found the facts specially, Rule 52 (a) of the Federal Rules of Civil Procedure, 28 U. S. C. A., is applicable * * *."

* * * * * * *

"This court recently in the case of Lichter v. Goss, 7 Cir., 1956, 232 F. 2d 715, 719, reaffirmed its holding in West v. Schwarz, 7 Cir., 1950, 182 F. 2d 721, 722, where we said:

"'However, it is not the functions of this court to pass upon or consider de novo the evidence received upon the trial, Webb v. Frisch, 7 Cir., 111 F. 2d 887, **nor to weigh the controverted evidence**

> Smith v. American Transit Lines, Inc., 7 Cir., 163 F. 2d 1014. Our duty is merely to ascertain whether the record discloses substantial evidence to sustain the findings of the trial court. Findings of fact shall not be set aside unless clearly erroneous, giving due regard to the opportunity of the trial court to judge of the credibility of the witnesses.' (Emphasis added.)

"Here the evidence was largely oral and the testimony of appellants cannot be reconciled with that of appellees. 'The rule requires that an appellate court make allowance for the advantages possessed by the trial court in appraising the significance of conflicting testimony and reverse only "clearly erroneous" findings.' Graver Tank & Mfg Co. v. Linde Air Products Co., 1949, 336 U. S. 271, 275."

2. Decision from the Eighth Circuit, which indicates reweighing of the evidence:

In **United States v. First Trust Co. of St. Paul**, 116 U. S. P. Q. 172 (C. A. 8—1958), Judge Vogel said (p. 175):

> "* * * We may not substitute our judgment for that of the finder of the facts. Rule 52 (a), F. R. C. P., 28 U. S. C. A."

But they he continued (pp. 175, 176):

> "* * * The view of this court on the applicability of Rule 52 (a) in nonjury or jury-waived cases is summarized in Commercial Standard Ins. Co. v. Maryland Cas. Co., 8 Cir., 1957, 248 F. 2d 412:
>
> "'In a nonjury case, this Court may not set aside a finding of fact of a trial court unless there is no substantial evidence to sustain it, **unless it is against the clear weight of the evidence**, or unless it was induced by an erroneous view of the law.' * * *" (Emphasis ours.)

* * * * * * *

> "We find that the conclusions of the trial court are based on substantial evidence, **are not against the clear weight of the evidence**, and were not induced by an erroneous view of the law." (Emphasis ours.)

This Court has spoken on Rule 52 (a), but it is obvious that it should speak again. The court below and others misapprehending this Court's directives should be instructed to the effect that the clear meaning of Rule 52 (a) does **not** permit a Court of Appeals in respect to the fact findings to **reweigh and reevaluate conflicting evidence** or to **judge of credibility of** witnesses, but that it **limits review** to a determination of whether or not there is **substantial supporting evidence**, which fully satisfies the rule.

CONCLUSION.

For the reasons stated, the Petition for Rehearing should be granted.

Respectfully submitted,

LAWRENCE C. KINGSLAND,
ESTILL E. EZELL,
HAROLD J. KINNEY,
M. K. HOBBS,
WELCH JORDAN,
Attorneys for Petitioner.

February 19, 1958.

Certificate.

It is hereby certified that this Petition for Rehearing is presented in good faith and not for delay, and that it is restricted to substantial grounds available to Petitioner but not previously presented.

Estill E. Ezell